HITACHI

Model V-301,302

Oscilloscope

SERVICE MANUAL

Hitachi Denshi, Ltd.

TOKYO, JAPAN

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1. SPECIFICATION

CRT Display	
Type	130BTB31
Acceleration Voltage	4KV
Effective display area	8 × 10 div (1 div=9.5mm)
Vertical amplifier	
(Identical for both channels)	5mV/DIV ~ 5V/DIV
Sensitivity:	Calibrated in 10 steps (1-2-5 Sequence up to about 2.5 times with variable control)
	1mV ~ 1V/DIV (using x5 GAIN)
Bandwidth	DC to 30MHz $^{+1}_{-3}$ dB
	DC~5MHz $^{+1}_{-3}$ dB (using x5 GAIN)
Rise time	12nSec
Signal delay time	Possible to observe the leading edge of waveform.
Input impedance	1M Ω shunted by 30pF ±5pF (direct)
Input coupling	AC, GND, DC
Max.input voltage	$600V_{p-p}$, 300V(DC+AC peak)
Input connector	BNC
Time base	
Sweep speed	0.2 μs ~ 0.2s/DIV
	19 step, 1-2-5 sequence
Magnification	x10 (max speed 100 ns/div)
X-Y display	
(V-301: X=Ext TRG or [X] IN, Y=INPUT)	
Sensitivity	Y axis: 5mV/DIV ~ 5V/DIV
	X axis: Approx. 0.2V/DIV
Bandwidth	X axis: DC ~ 500 KHz
X-Y phase	Less than 3° at 10 KHz
(V-302: X=CH1, Y=CH2)	

Sensitivity — Y axis: 5mV/DIV ~ 5V/DIV
X axis: Approx. 0.2V/DIV

Bandwidth — X axis: DC ~ 500 KHz

X-Y phase — Less than 3° at 10 KHz

Synchronization

Trigger sensitivity

Frequency	INT. trig	EXT. trig
20Hz ~ 5MHz	0.5DIV	200 mV
5MHz ~ 30MHz	1.5DIV	800 mV

Vertical MODE (V-302)

MODE; CH1, CH2 (X-Y), DUAL, ADD, DIFF

DUAL: DUAL trace display

ADD: CH1 and CH2 are added

DIFF: CH2 and CH2 (inverted signal) are added

Trigger MODE

AUTOmatic : Sweep free-runs.

NORMal : Sweep runs when triggered.

TV(+),TV(-): Extracts the synchronizing signal from com posite video signal and provides stable synchronization. Slope switch is selected according to polarity of video signals.

SOURCE; INTernal (V302; CH1 or CH2) or EXTernal or LINE.

Calibration

Wave form — squre wave 1KHz $\pm$10%

Voltage — 0.5 V_{p-p} $\pm$5%

Power supply	AC 100/120/220/240V
Size and weight	190(H) × 275(W) × 400(D)mm 8.5Kg
	[7.5(H)×10.8(W) × 15.7(D)in 18.7 lbs]

2. COMPOSITION

(1) V-301, V-302 oscilloscope ···1

(2) AT-10AB1.5 Probe ·····1(V-301), 2(V-302)

(3) Operation manual ·····1

3. PREVENTIVE MAINTENANCE

Preventive maintenance, when performed on a regular basis, can prevent instrument breakdown and may improve the reliability of the oscilloscope. The severity of environment to which this instrument is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

Disassembly

Remove the 6 screws in the top cover of the instrument. Gently separate the top cover from the instrument and lay aside. Most of the internal parts of the instrument are now accessible.

If access to the front of the Input circuit board is necessary, remove the knobs from all of the external control shafts. Remove the two screws securing the side panel to the Input circuit board and remove the instrument side panel. (See 5. DISASSEMBLY ILLUSTRATION.)

Cleaning

The instrument should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause component breakdown.

The covers provide protection against dust in the interior of the instrument. Loose dust accumulated on these covers can be removed with a soft cloth or small brush.
Dirt that remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

Cleaning the interior should only be occasionally necessary. The best way to clean the interior is to blow off the dust with a dry, low-velocity stream of air. A soft-bristle brush or a cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate components.

Visual Inspection

The instrument should be inspected occasionally for such defects as broken connections, improperly seated transistors, damaged circuit boards, and heat-damaged parts. The corrective procedure for most visible defects is apparant; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, correcting the cause of the overheating is important to prevent recurrance of the damage.

4. CALIBRATION.

Hitachi Denshi, Ltd. provides complete instrument repair and recalibration at our oversea's office, and authorized dealer. Contact your local Hitachi Denshi, Ltd. office or representative.

4.1 TEST EQUIPMENT REQUIRED

The following test equipment and accessories, or equivalent, are required for the complete calibration of the V-301, 302. The given specifications for the test equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment used must meet or exceed the listed specifications. All the test equipment is assumed to be correctly calibrated and operating within the listed specification. operating instructions for the test equipment are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

Table 4-1

TEST EQUIPMENT REQUIRED

Description	Minimum Specification	Usage	Examples of Applicable Test Equipment
1. Constant Amplitude Signal Generator	50kHz reference frequency; maximum frequency 40MHz; variable amplitude.	Check horizontal, vertical and trigger bandwidth.	
2, Standard Amplitude Calibrator	Amplitude accuracy: 0.25%, variable amplitude; 5mV to 40 V; frequency: 1 kHz square wave.	Check horizontal and vertical gain.	
3. Square-wave Ge Generator	Variable frequency: 10 Hz to 1 MHz; output amplitude; 10 mV to 100 V	Check probe and vertical compensation.	
4. Digital Multimeter	0.1% accuracy.	Check power supply	
5. Time Mark Generator	o.1% accuracy.	Check horizontal timing.	
6. Cable	Impedance, 50 ohms; type, RG-58/U; length, 42 inches, connectors, BNC.	External trigger operation check. Horizontal gain check and adjustment.	Hitachi Part No.4202
7. Termination	Impedance, 50 ohms; connectors, BNC	Vertical Amplifier compensation checks and adjustment.	Hitachi Part No.1401
8. Attenuator	Ratio, 10X; connectors, BNC; impedance, 50 ohms.	Vertical Amplifier bandwidth check.	Hitachi Part No.1501
9. T-Connector	Connectors, BNC.	External trigger operation checks.	Hitachi Part No.1301

4.2 PRELIMINARY PROCEDURE

This instrument should be calibrated at an ambient temperature of +20°C (±5°C) for best overall accuracy.

1. Connect the instrument to AC line voltage, 50/60 Hz line source.
2. Set the instrument controls as given in the Preliminary Control Settings. Allow at least fifteen minutes of warmup before proceeding.
3. See the Adjustment Locations in the pullout pages.

4.3 PRELIMINARY CONTROL SETTINGS

Preset the instrument controls to the settings given below, when starting the calibration procedures.

	V-301	V-302
FOCUS	Midposition	Midposition
TRACE ROTATION	Midposition	Midposition
V.POSITION	Midposition, push in	Midposition, push in
V.VARIABLE	CAL, fully clockwise	CAL, fully clockwise
AC-GND-DC	GND	GND
VOLTS/DIV		
V.MODE		CH1
TIME/DIV	1mS	1mS
SWP or [X] VAR SWP VAR	CAL, fully clockwise	CAL, fully clockwise
H.POSITION	Midposition, push in	Midposition, push in
Trig. LEVEL	Midposition, push in	Midposition, push in
Trig. MODE	AUTO	AUTO
Trig. SOURCE	INT	CH1

Table 4-2
PRELIMINARY CONTROL SETTING.

4.4 INITIAL STARTING PROCEDURE

1. Rotate POWER/INTENSITY control to the midposition.
2. Wait a few seconds for the cathode ray tube (CRT) to warm up. A trace should appear on the fact of the CRT.
3. If no trace appears, increase (clockwise) the POWER/INTENSITY control setting until the trace is easily observed.
4. Adjust FOCUS control for the thinnest, sharpest trace.
5. Readjust POSITION controls if necessary, to center the trace.

POWER SUPPLY SYSTEM

NOTE

Before you begin, see ADJUSTMENT LOCATIONS in the pullout pages.

Control Settings

Preset the controls as given in the Preliminary Control Setting.

1. Check Low-voltage Supply, if necessary
   a. Connect the digital voltmeter (DVM) from the +5 volt line.
      :+5V ±5% (IC1131)
   b. Connect the DVM from the +12V line
      :+12V ±5% (IC1111)
   c. Connect the DVM from the -12V line
      :-12V ±5% (IC1121)
   d. Connect the DVM from the +120V
      :+120V ±5%
2. Check/Adjust High Voltage Supply
   a. Connect the DVM to the H.V test point
   b. Check for a reading of 1350V ±40V

c. Adjust the High Voltage adjustment RV1001 for nearly 1350V

3. Check/Adjust Grid Bias

a. Rotate the POWER/INTENSITY to the $^{1}/_{3}$ of fully way as shown.

b. Observe the trace of CRT.

c. Adjust Grid Bias Adjustment RV1021 for the trace makes an appear.

DISPLAY

Control Setting

Preset the controls as given in the Preliminary Control Setting.

4. Check/Adjust ASTIG matism and FOCUS.

a. Set the TIME/DIV switch to the X-Y position, and Vertical MODE (in case of V-302) switch to the CH2/X-Y position.

b. Set the POWER/INTENSITY control for a small spot, near center of screen using position controls.

c. Check that the spot is round.

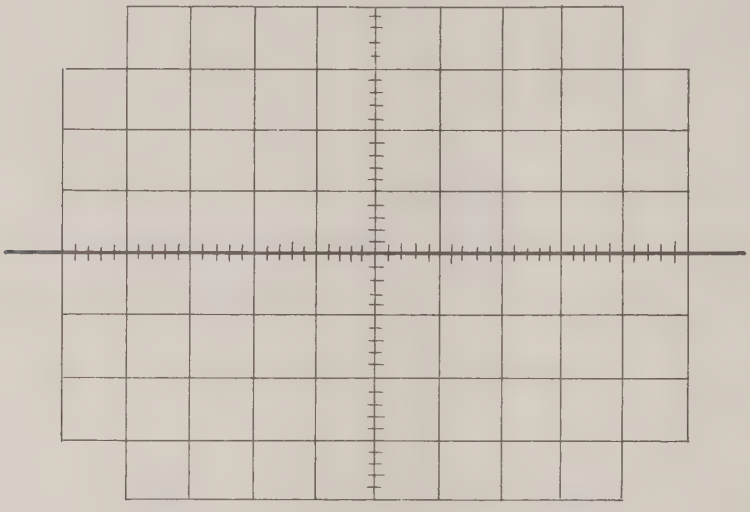
d. Adjust the FOCUS adjustment and the ASTIG adjustment RV1035 for a round spot.

5. Check/Adjust Trace Rotation

a. Set the TIME/DIV switch to 1mS.

b. Check that the trace is parallel to the center horizontal line.

d. Adjust TRACE ROTATION for a trace that is parallel with the horizontal graticule lines.



6. Check/Adjust GEOMetry

   a. Set the TIME/DIV switch to the lmS, and AC-GND-DC to DC.

   b. Connect the Constant Amplitude Signal Generator to the input.

   c. Set the VOLTS/DIV switch setting for a full-screen (8 division) deflection.

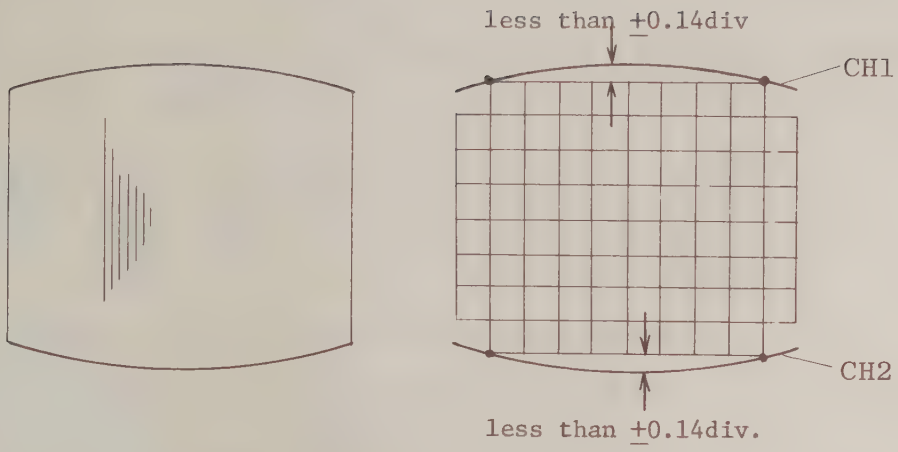
   d. Check that horizontal bowing is less than $\pm$0.14 division.

   e. Adjust the GEOM adjustment RV1034 for a display that is parallel with top and bottom horizontal lines.

Note;

For the V-302, also it is possible the adjustment of GEOM as follow.

   a. Set the verticul MODE to the DUAL.



b. Rotate the POSITION (CH1) control to the top the trace

c. Rotate the POSITION (CH2) control to the bottom the trace

d. Check and Adjust as before methode.

VERTICAL SYSTEM

Control Setting

Preset the controls as given in the Preliminary Control Settings.

7. Check/Adjust DC Balance (Step attenuator balance).

   a. Set the VOLTS/DIV switch to the 5mV position.

   b. Position the trace to the horizontal center line.

   c. Change the VOLTS/DIV switch to the 10mV position.

   d. Check that the trace is within 0.2 division of the center horizontal line.

   e. Adjust the DC BAL adjustment, RV11(CH1) or RV111(CH2), for a trace at the horizontal center line.

   f. Repeat part (a) through (e) until less than 0.2 division shift is noted when changing the VOLTS/DIV setting.

8. Check/Adjust Vertical Position Center.

   a. Confirm the vertical POSITION control at the midposition.

   b. Check the trace is within 1 division.

   c. Adjust the Position Center adjustment RV44(CH1), RV144(CH2) for a trace at the horizontal center line.

9. Check/Adjust ×5 AC GAIN

   a. Set the TIME/DIV switch to the 1mS position.

   b. Set the VOLTS/DIV switch to the 5mV position.

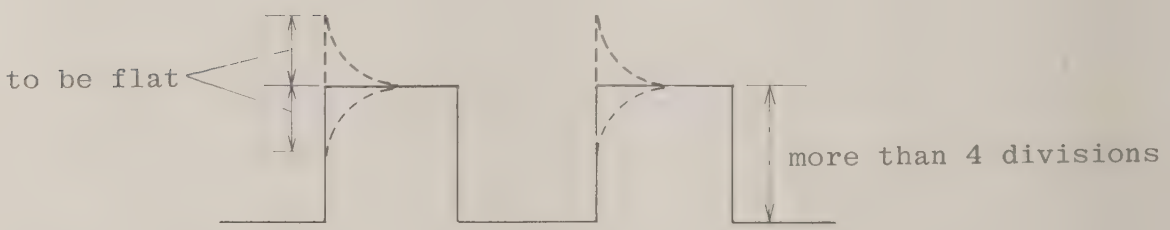
   c. Pull the vertical POSITION/ × 5 GAIN out.

   d. Connect the Square-wave Generator (using 1KHz out put range).

   e. Adjust the output amplitude of that generator for more than 4 division deflection of screen.

   f. Check the high-voltage level of pulse is flat.

   g. Adjust the ×5 AC GAIN RV16(CH1), RV116(CH2) adjustment for a flat level.



10. Check/Adjust ×1 AC GAIN.

   a. Push the vertical POSITION switch in.

b. Refere item 9 part (a) through (f) (except (c)).

c. Adjust the ×1AC GAIN RV18(CH1), RV118(CH2) adjustment for a flat level.

11. Check/Adjust Vertical Gain.

a. Set the VOLTS/DIV switch to the 5mV position and AC-GND-DC switch to DC.

b. Connect the standard amplitude calibrator to the input.

c. Set the standard amplitude calibrator for a $20mV_{p-p}$ (4 divisions of display) signal.

d. Check for a display of four divisions.

e. Adjust RV43(CH1), RV143(CH2) for a display of 4 divisions within 5%.

f. Check all the VOLTS/DIV switch settings.

12. Check/Adjust CAL terminal ($0.5V_{p-p}$).

a. Set the VOLTS/DIV switch to the 0.1V position.

b. Connect the CAL to the input.

c. Check for a display of five divisions.

d. Adjust RV1203 for a display of 5 divisions within 5%.

13. Check/Adjust Attenuation Compensation.

a. Set the VOLTS/DIV switch to the 0.1V position and AC-GND-DC switch to DC.

b. Connect the square-wave generator to the input for a 0.5V signal.

c. Check for a square wave that is flat (flat top).

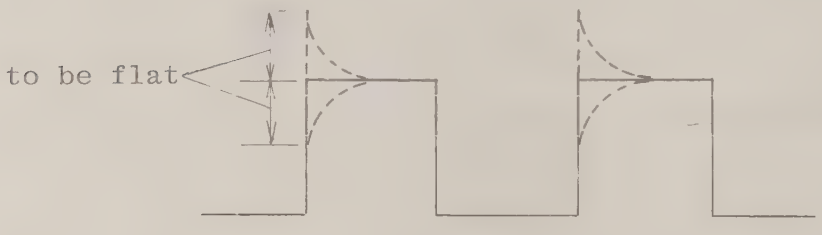
d. Adjust CV2(CH1), CV102(CH2) for a square wave that is flat (flat top).

e. Set the VOLTS/DIV switch to the 1V position.

f. Set the square-wave generator for a 5V signal.

g. Check for a square wave that is flat.

h. Adjust CV4(CH1), CV104(CH2) for a square wave that is flat.



14. Check/Adjust Probe Compensation.

a. Set the VOLTS/DIV switch to the 5mV position.

b. Connect the square-wave generator to the input. Use a plobe AT-10AB1.5.

c. Set the square-wave generator for a 0.2V signal.

d. Adjust the LEVEL control for a stable display, triggered on the positive excursion of the waveform.

e. Check that positive excursion of the displayed square wave is flat (flat top).

f. Adjust the trimmer capacitance of that plobe (in figure) the display is flat.

g. Set the VOLTS/DIV switch to the 0.1V position.

h. Set the square-wave generator for a 5V signal.

i. Check for a square wave that is flat.

j. Adjust CV1(CH1), CV101(CH2) for a square wave that is flat.

k. Set the square-wave generator for a 50V signal.

l. Check for a square wave that is flat.

m. Adjust CV3(CH1), CV103(CH2) for a square-wave that is flat.

15. Check/Adjust Vertical Step Response.

a. Set the VOLT/DIV switch to the 5mV position.

b. Set the TIME/DIV switch to the 5μS position, if necessary, to the 2μS position setting.

c. Pull the ×10 MAG switch out for a magnified display.

d. Connect the first-rise, positive output of the square-wave generator to input. Use a 50-ohm termination and cable.

e. Set the square-wave generator to 100kHz. Adjust the square wave generator output for a 4-divisions display.

f. Position the positive-going signal in the center of the graticule, with the top of the square wave visible.

g. Adjust CV330 and CV316 for a square wave that is flat.
And adjust CV42(CH1) CV142(CH2), and CV323 for the fastest rise time.
(A slight readjustment of the CV42, 142,CV316 might be necessary for a flat top with 0 ~ +8% over-shoot.)

16. Check/Adjust Vertical Bundwidth.

a. Set the VOLTS/DIV switch to 5mV, the TIME/DIV switch to 1mS and ×1 GAIN.

b. Connect the constant amplitude signal generator to the input. Use a 50-ohm termination.

c. Set the constant amplitude signal generator to 50kHz, and adjust the output amplitude of it for a deflection of four divisions.

d. Adjust the frequency of the constant amplitude signal generator until 2.8 divisions of delfection are present on the CRT screen.

e. Check that the frequency of the constant amplitude signal generator is greater than 30MHz.

f. Adjust item 15 for delfection of at least 2.8 divisions at 30MHz. Check display for a clean step response.

SWEEP TRIGER

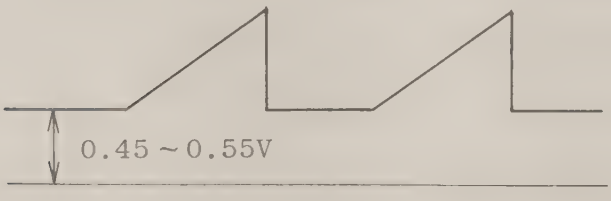
Control Settings

Preset the controls as given in the Preliminary Control Settings.

17. Check/Adjust the Sweep Start.

a. Check the voltage in TR502, collector for a +o.45V ~ +0.55V.

b. Adjust the RV504 for a +0.45V ~ 0.55V at that point.



HORIZONTAL SYSTEM

Control Settings

Preset the controls as given in the Preliminary Control settings.

18. Check/Adjust Horizontal Gain (Sweep Cal.)

    a. Set the TIME/DIV switch to the 1mS.

    b. Set the horizontal gain for a ×1 MAG.

    c. Set the input AC-GND-DC to DC.

    d. Connect the cable to the output of the time mark generator.

    e. Set the time mark generator for 1mS time marks.

    f. Check that the time marks align with the graticule lines over the center eight divisions.

    g. Adjust RV812 at that the time marks align with the center eight graticule lines.

    h. Check all other ranges of timing within 5%. Use appropriate settings on the time mark generator.

    i. Set ×10 MAG (push out).

    j. Adjust RV816 for one-cycle time marks align with the ten-divisions graticule lines.

19. X-Y Operation.

19-1 Check/Adjust X position Center

-V-301-

a. Set the TIME/DIV switch to [X-Y] position; the horizontal POSITION control to midposition.

-V-302-

a. Set the TIME/DIV switch to [X-Y] position, the vertical MODE switch to CH2/ [X-Y] position and the horizontal POSITION control to midposition.

c. Check a round spot for the center graticule within/ division against horizontal line.

d. Adjust RV806 the spot for the center.

19-2. Check/Adjust X Gain.

— V-301—

a. Set the AC-AND-DC switch to GND.

b. Set the TIME/DIV switch to [X-Y] .

c. Connect the standard amplitude calibrator to the EXT TRIG or [X] in.

d. Set the standard amplitude calibrator for a IV_{p-p}.

e. Check for a display of five divisions.

f. Adjust RV273 for a display of 5 divisions.

—V-302 —

a. Set the TIME/DIV switch to [X-Y] .

b. Set the AC-GND-DC switch of CH1 to DC, the AC-GND-DC switch of CH2 to GND.

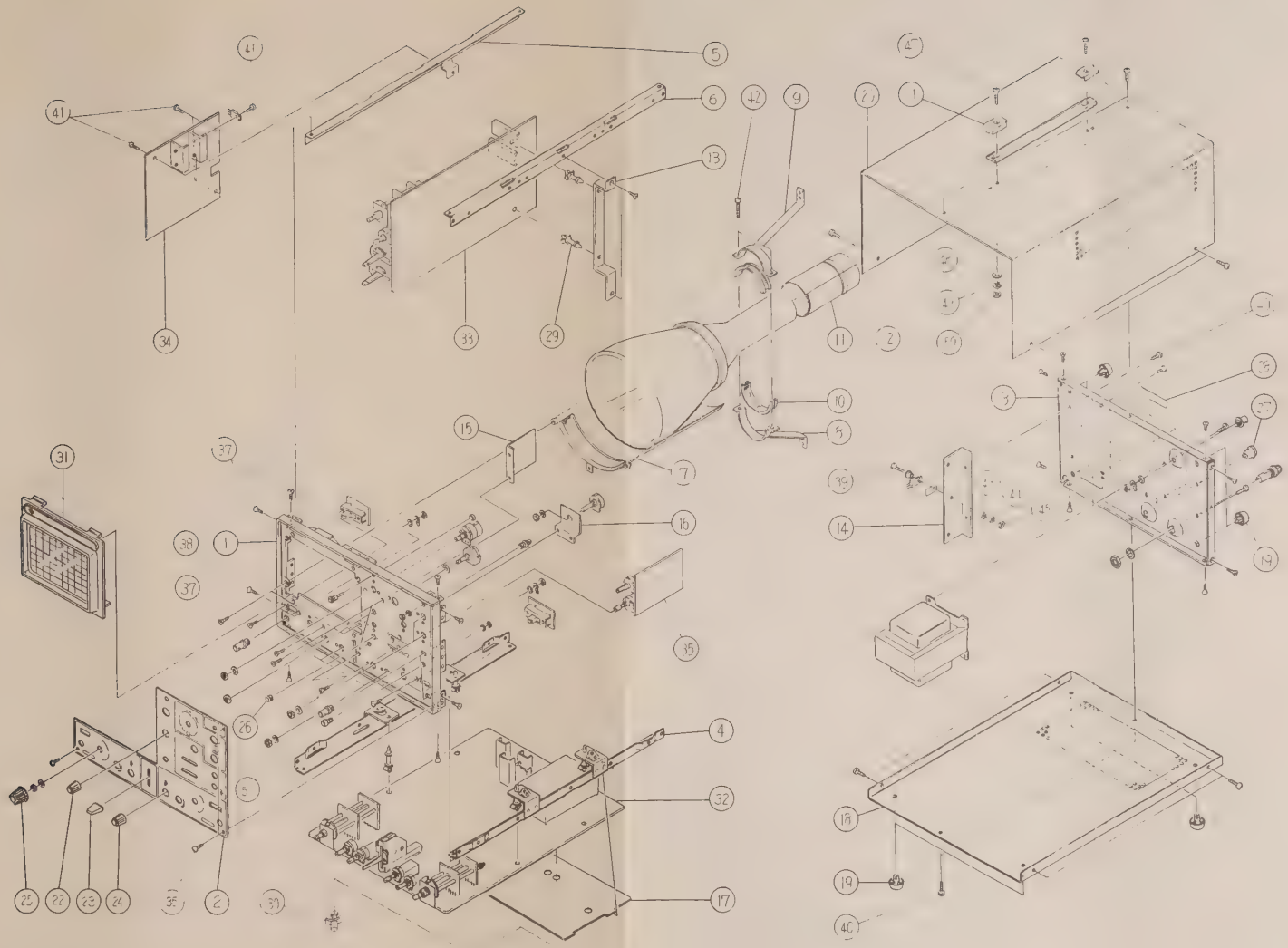
c. Set the VOLTS/DIV switch to the 5mV position, with 1 GAIN.

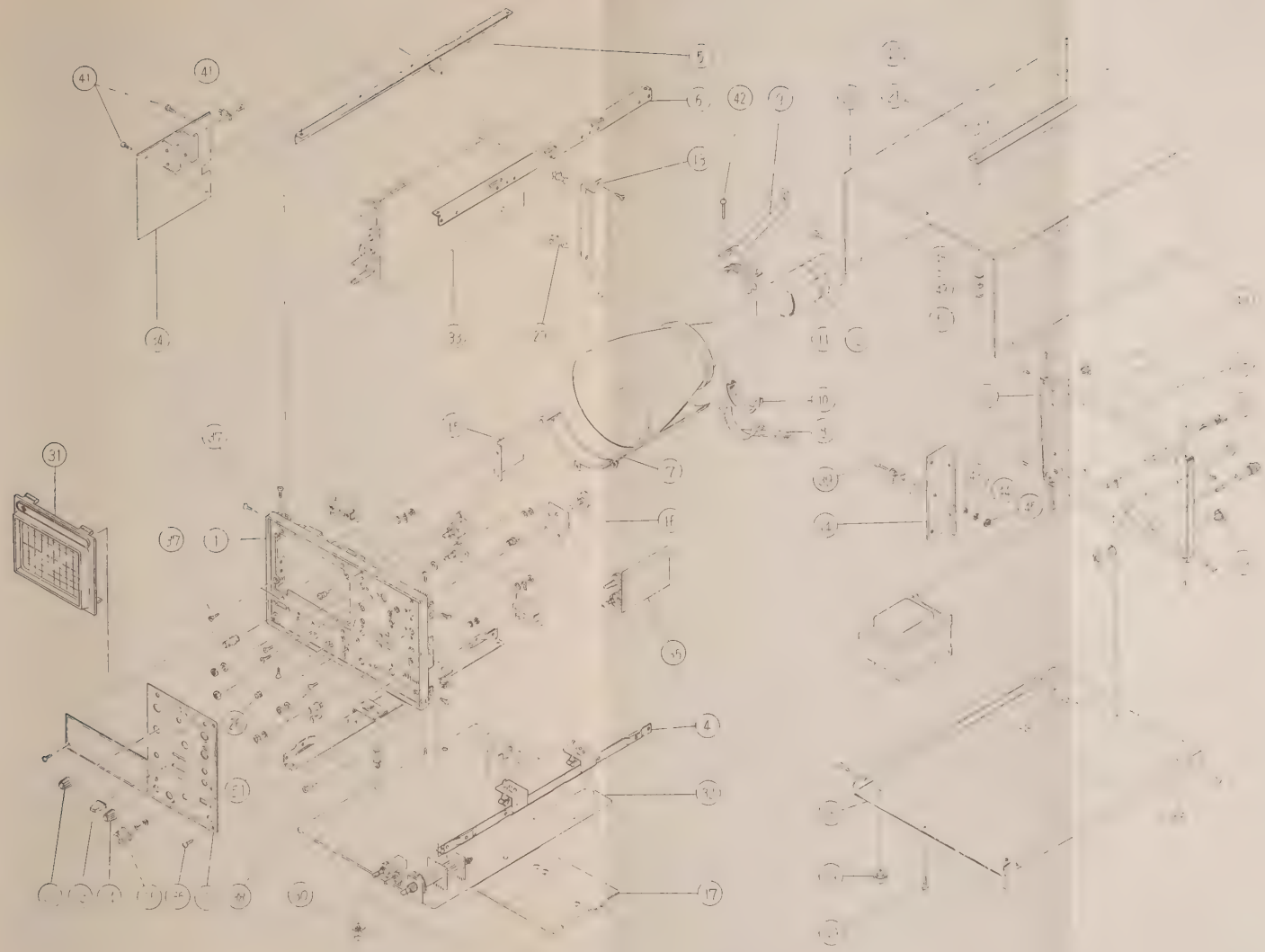
d. Connect the standard amplitude calibrator to the CH1 input.

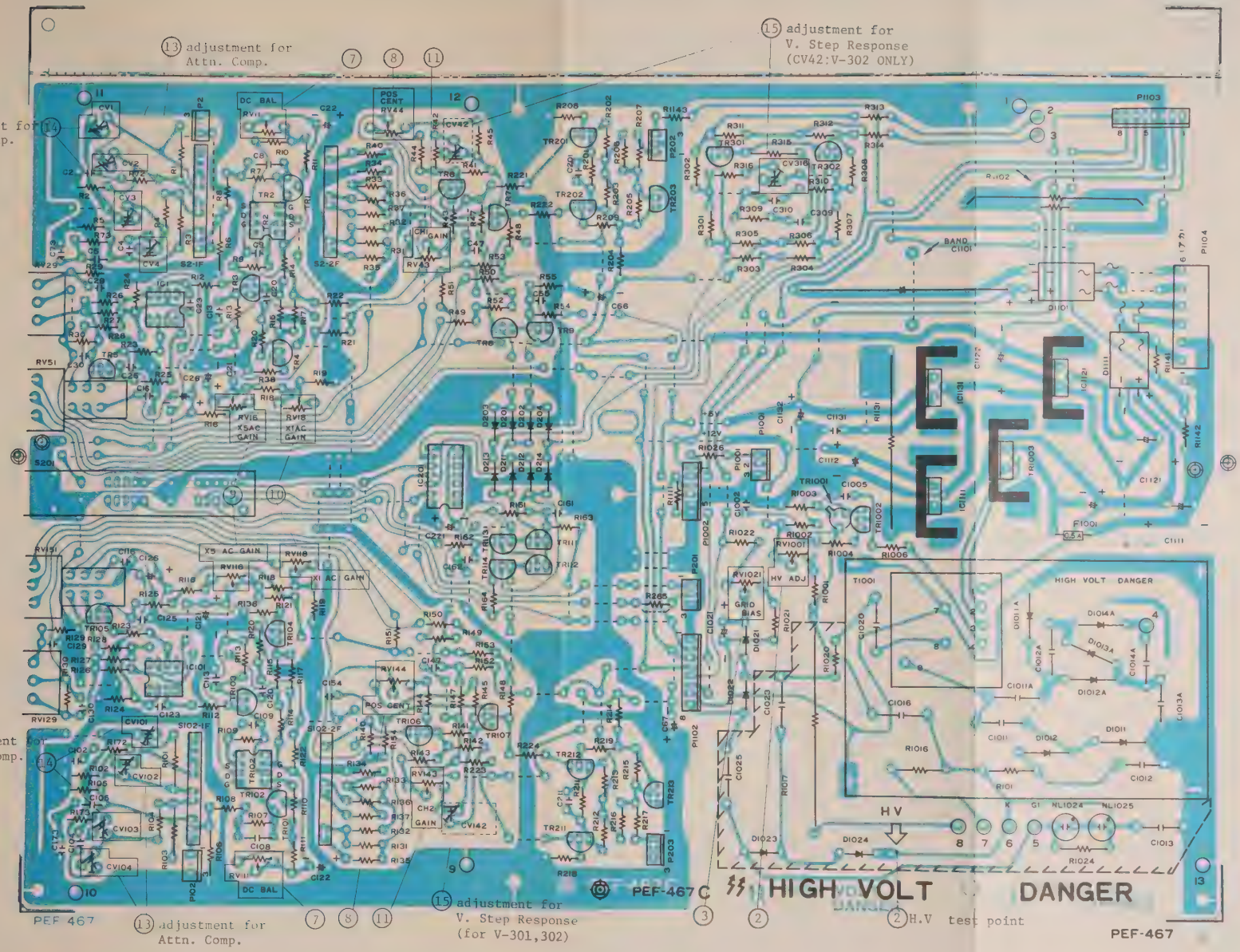
e. Set the standard amplitude calibrator for a 20 mV.

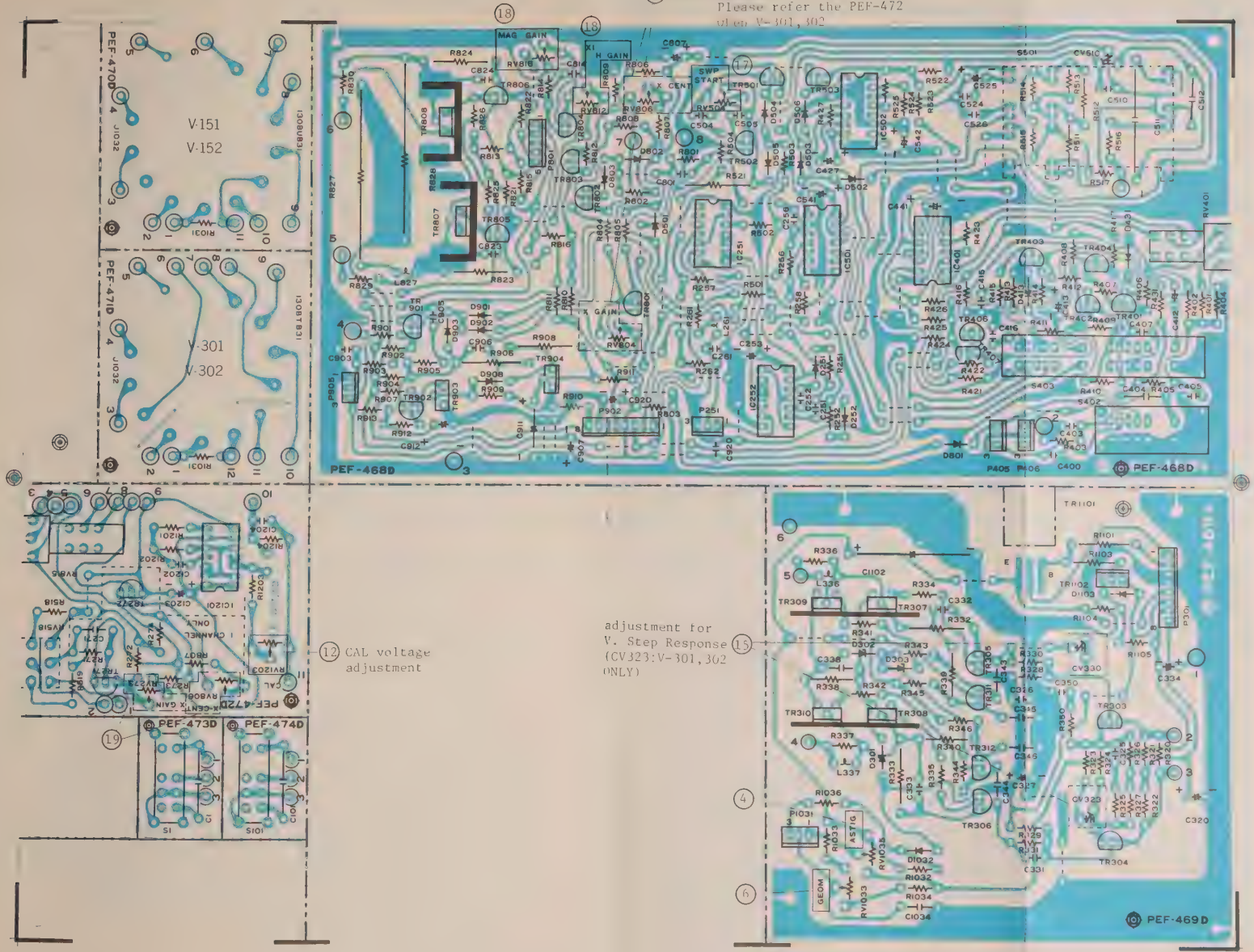
f. Check for a display of 4 divisions.

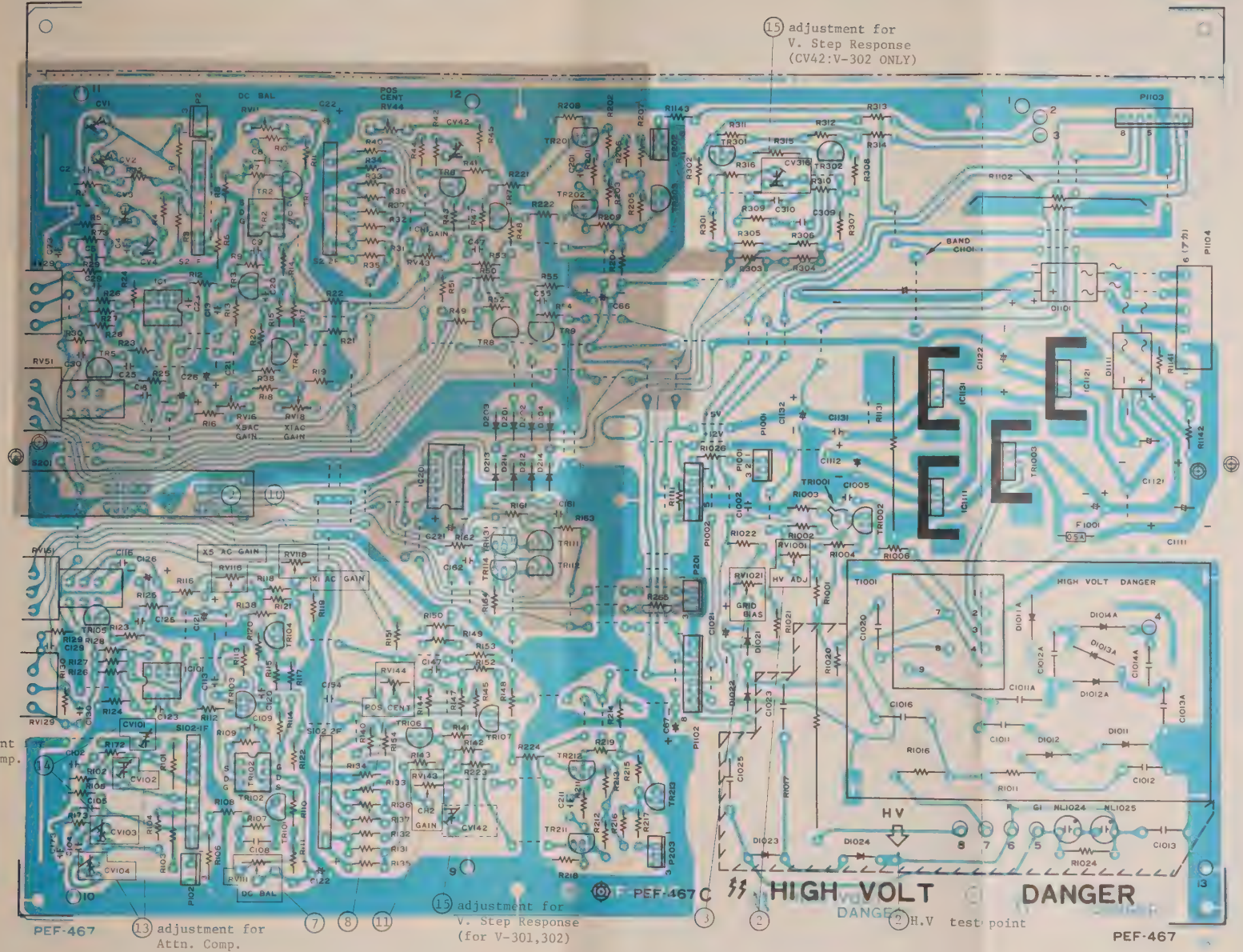
g. Adjust RV804 for a display of four divisions.

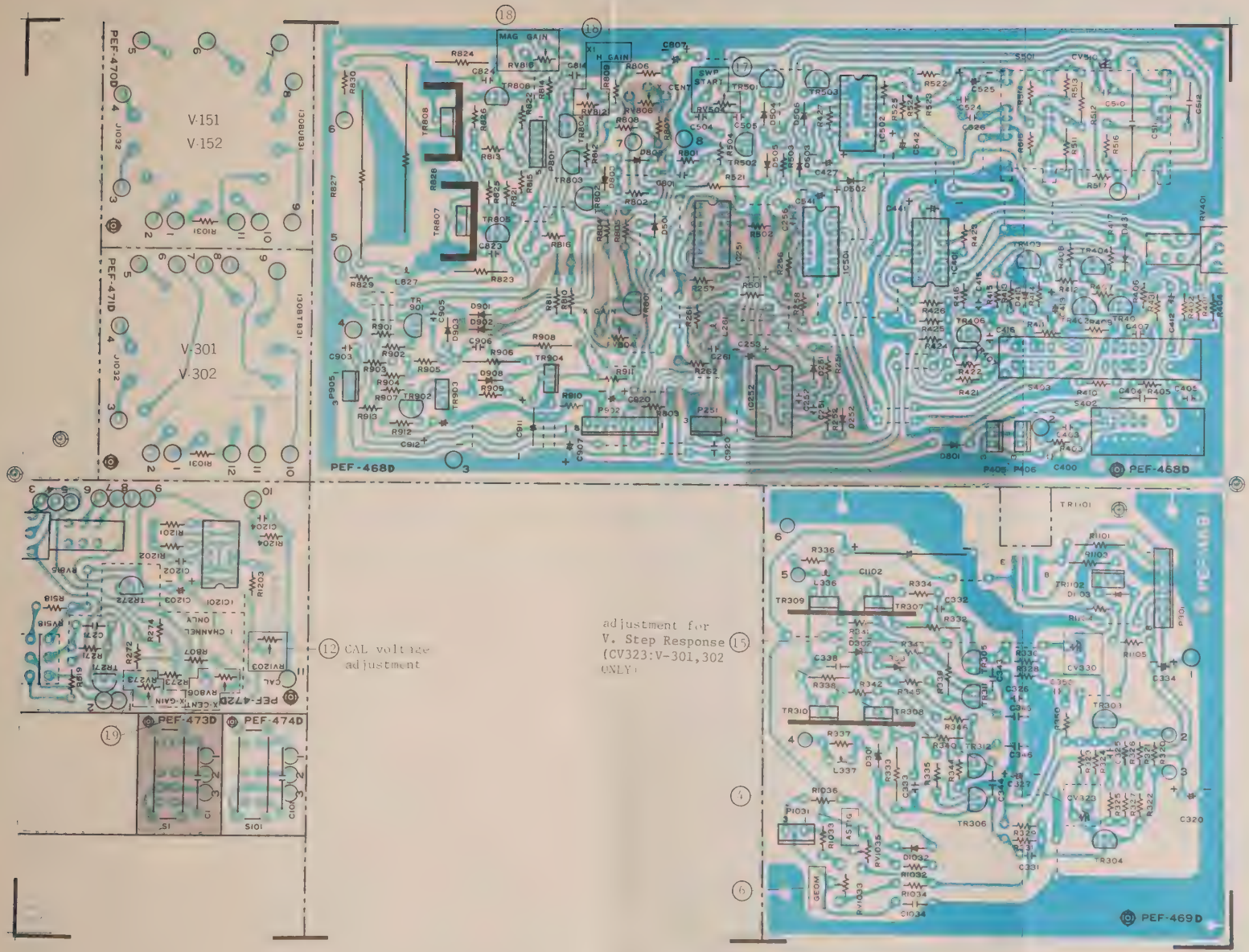





(13) adjustment for Attn. Comp.
(15) adjustment for V. Step Response (CV42:V-302 ONLY)
(14) adjustment for Probe Comp.
(14) adjustment for Probe Comp.
(15) adjustment for V. Step Response (for V-301,302)
(13) adjustment for Attn. Comp.
(2) H.V test point
PEF-467
PEF-467
HIGH VOLT DANGER
HIGH VOLT DANGER
HV
DC BAL
POS CENT
CH1 GAIN
CH2 GAIN
S2-1F
S2-2F
S102-1F
S102-2F
X5 AC GAIN
X1 AC GAIN
HV ADJ
GRID BIAS
BAND
NL1024
NL1025

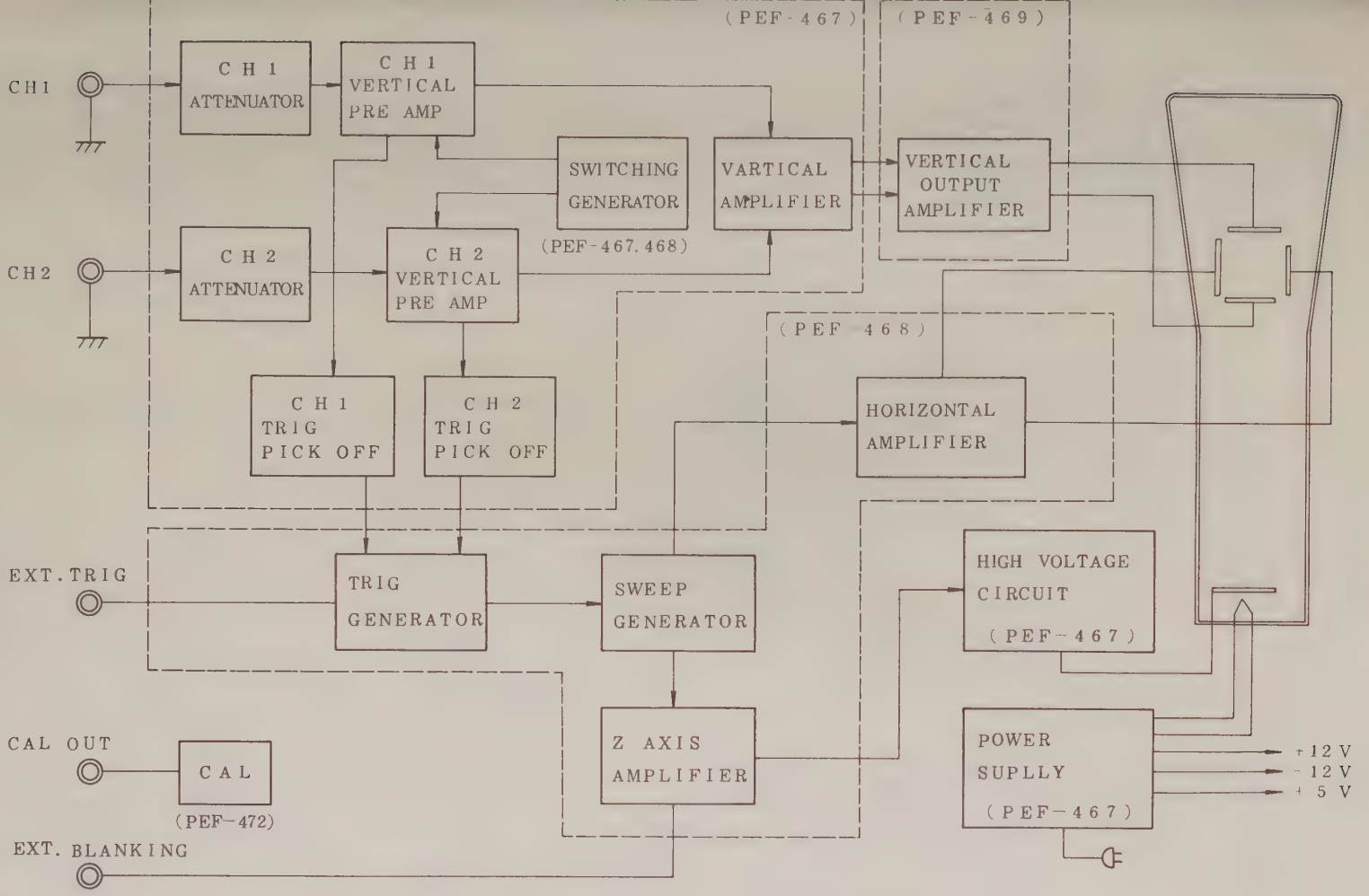

(19) Note: Using for V-152,302
Please refer the PEF-472
also V-301,302
PEF-470D
V-151
V-152
PEF-471D
V-301
V-302
PEF-468D
PEF-468D
PEF-472D
PEF-473D
PEF-474D
PEF-469D
(12) CAL voltage adjustment
adjustment for V. Step Response (CV323:V-301,302 ONLY)
(15)


(15) adjustment for V. Step Response (CV42:V-302 ONLY)
adjustment for Probe Comp.
(13) adjustment for Attn. Comp.
(15) adjustment for V. Step Response (for V-301,302)
(2) H.V test point
HIGH VOLT DANGER
PEF-467

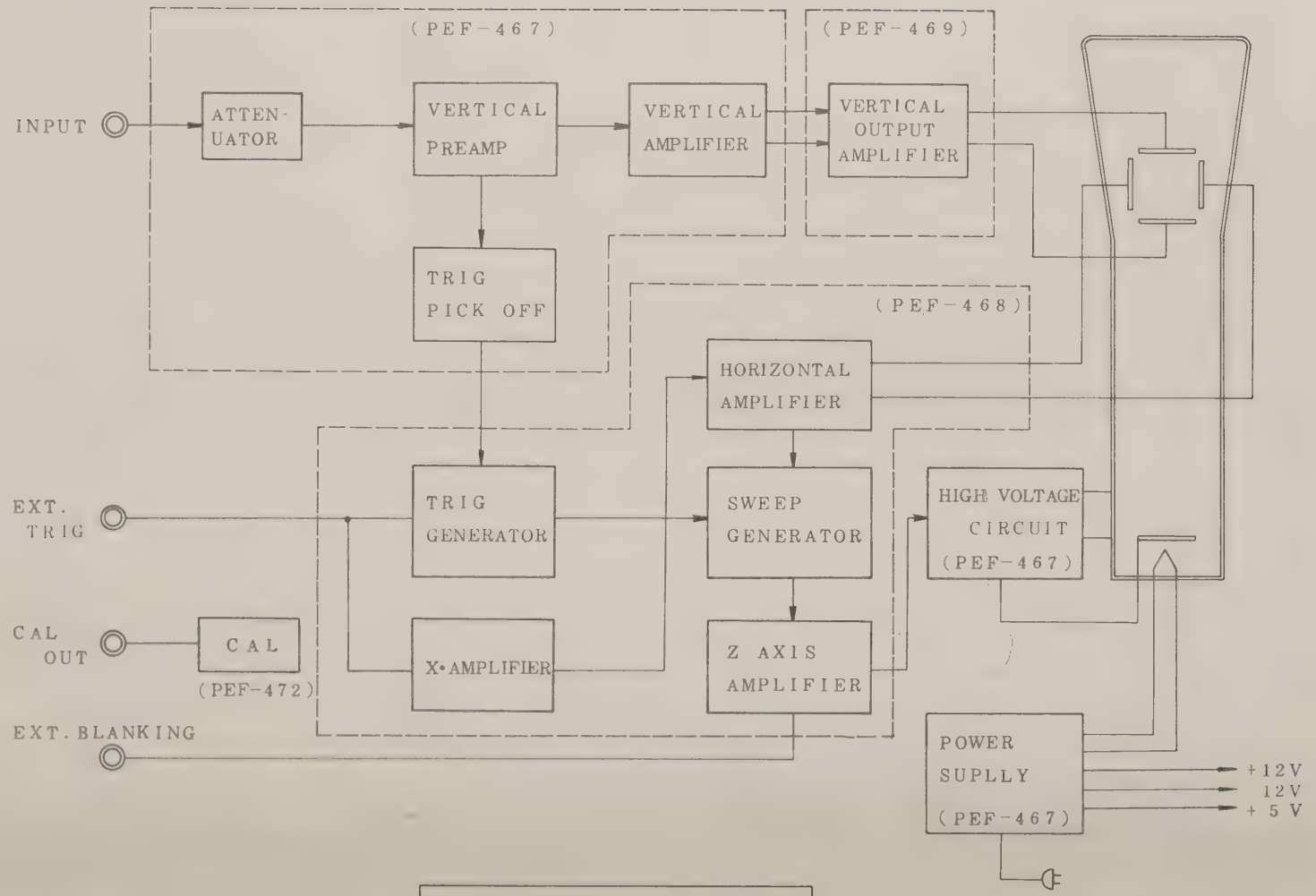

PEF-470D
V-151
V-152
PEF-471D
V-301
V-302
PEF-468D
PEF-469D
PEF-472D
PEF-473D
PEF-474D
MAG GAIN
H GAIN
X GAIN
SWP START
CHANNEL ONLY
X-CENT
X-GAIN
CAL
ASTIG
GEOM
(12) CAL voltage adjustment
adjustment for V. Step Response (CV323:V-301,302 ONLY)
(15)

DIAGRAM

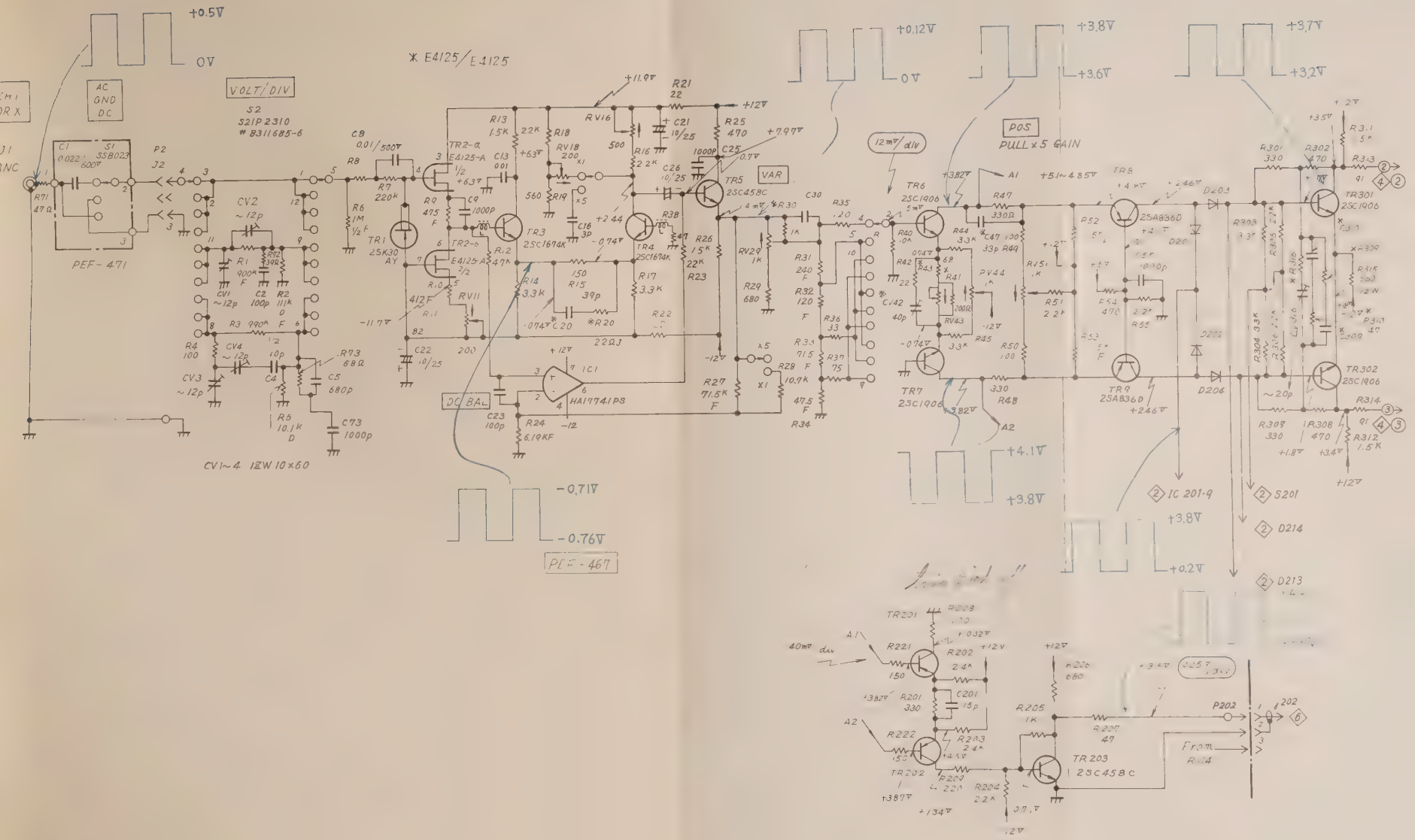
※ : Refer to ELECTRIC PARTS LIST, when this symbol is remarked.



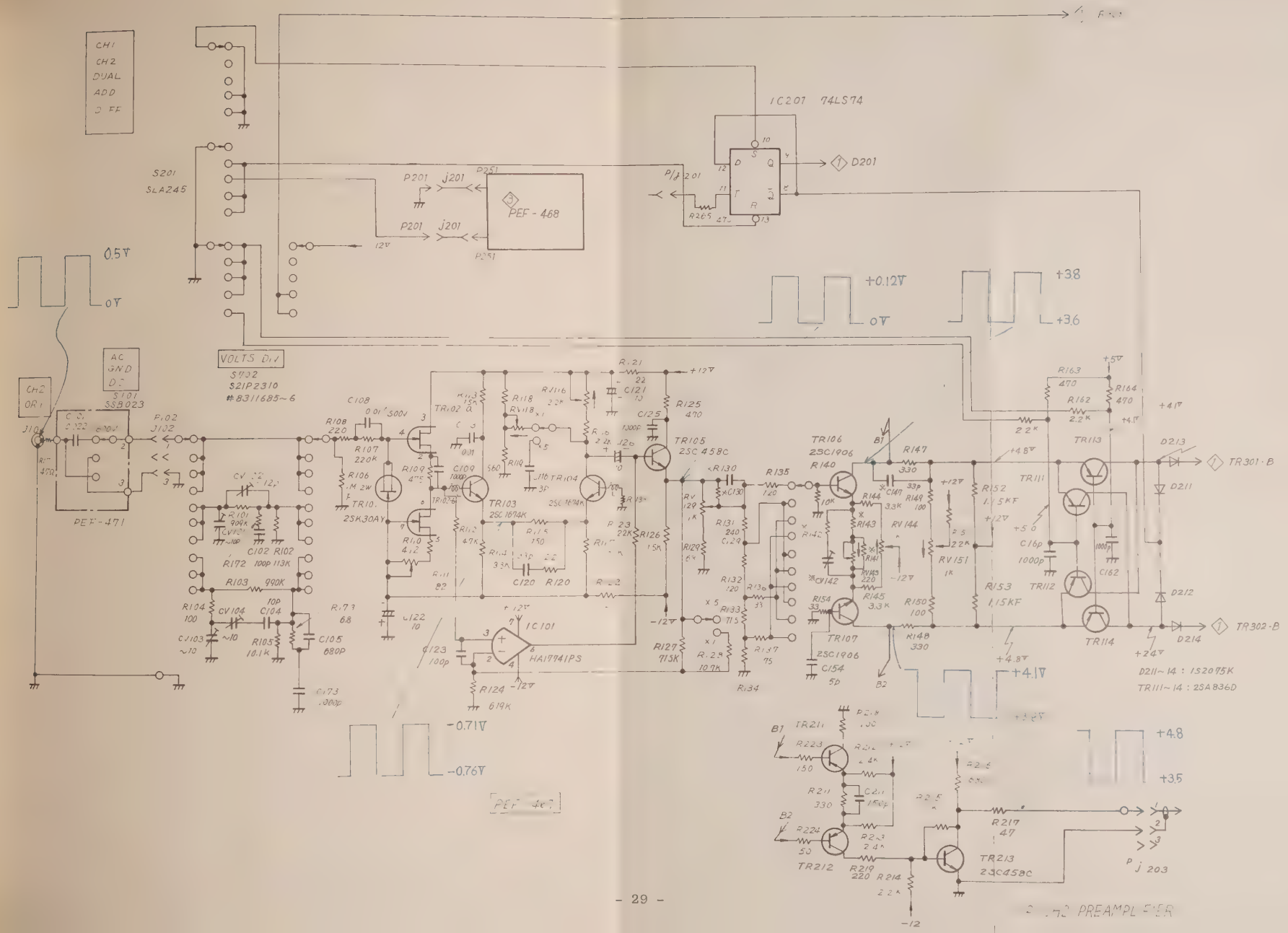
BLOCK DIAGRAM

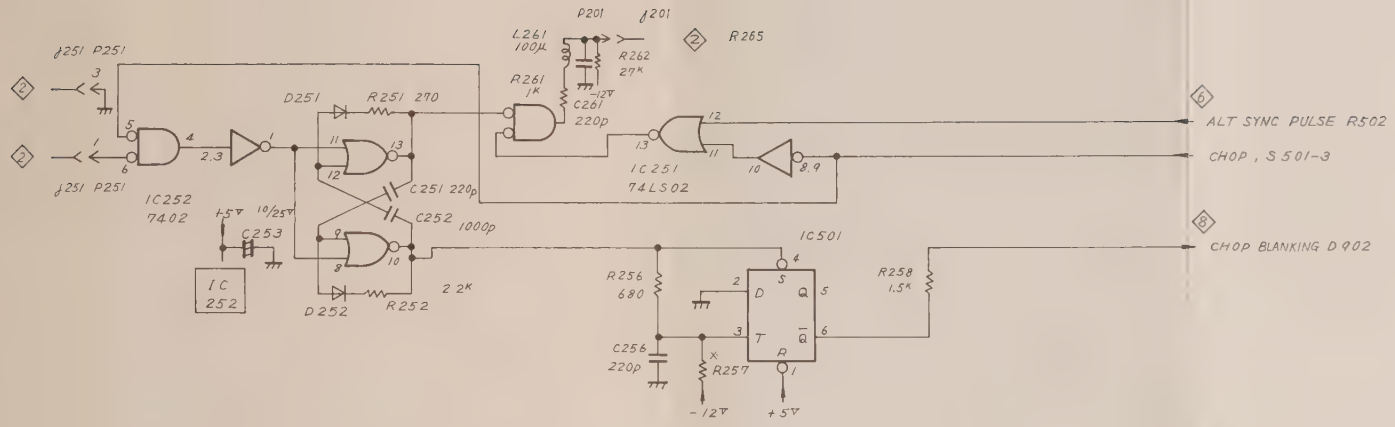


BLOCK DIAGRAM



① CH1 PREAMPLIFIER

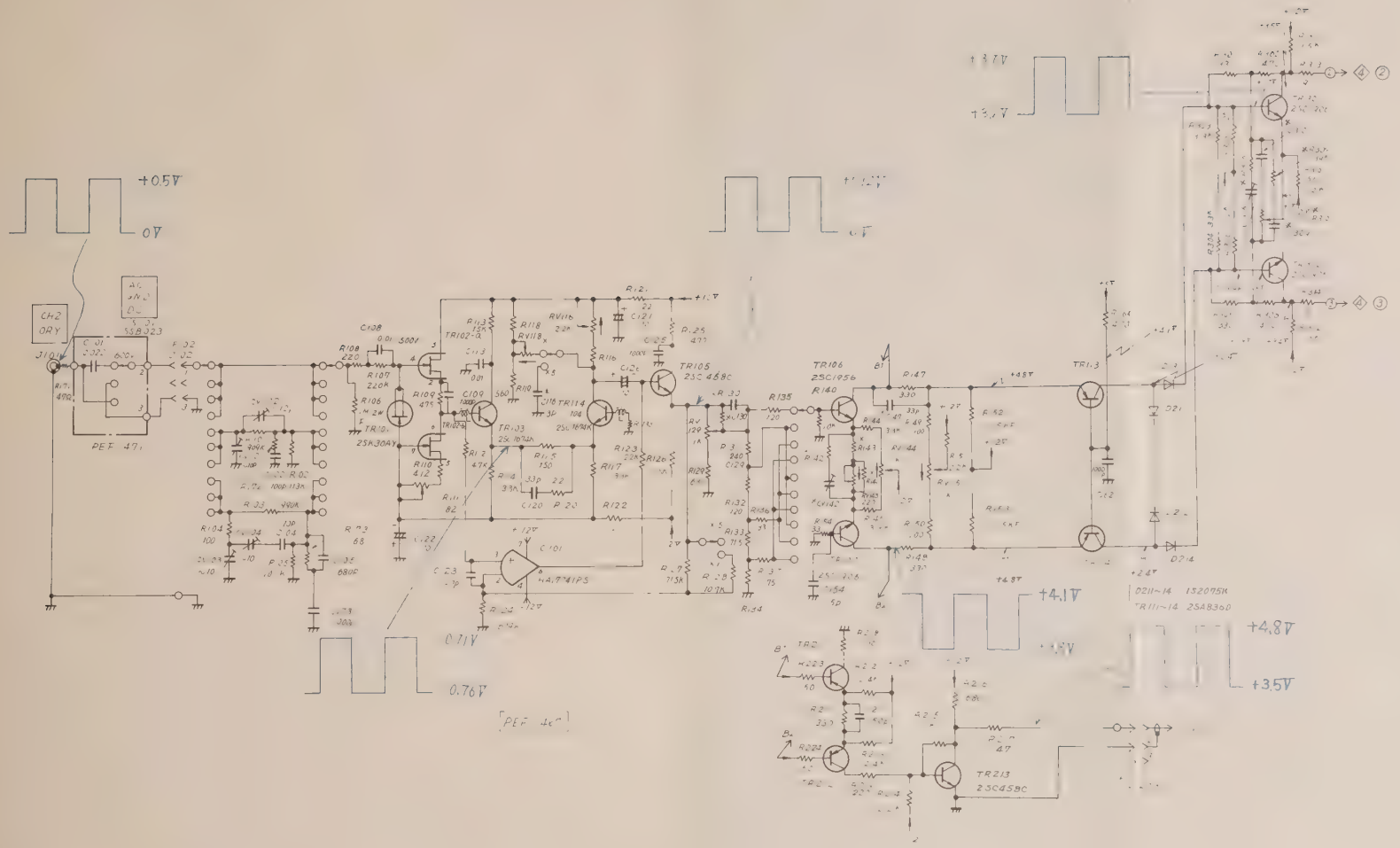

CH1
CH2
DUAL
ADD
INV
S201
SLA245
P201
J201
P251
PEF-468
12V
IC207 74LS74
D201
R265 47
0.5V
0V
+0.12V
0V
+3.8
+3.6
AC
GND
DC
S101
SSB023
VOLTS DIV
S102
S21P2310
#8311685~6
CH2
OR1
J102
PEF-471
C101 0.22 250V
R107 220K
R106 M 2W
TR101 2SK30AY
C108 0.01 500V
R108 220
TR102 A
TR102 B
TR103 2SC1674K
TR104 2SC1674K
R109 47K
C109 1000P
R110 4.12
R111 82
R112 4.7K
R113 150
R114 3.3K
C120 R120
R118
RV116 22K
RV118 x1
R119 560
C116 3P
R121 22
C121 10
C122 10
C123 100P
R122
R123
R124 619K
IC101
HA17741PS
-0.71V
-0.76V
[PEF-467]
R125 470
C125 1000P
TR105 2SC458C
R126 15K
R127 715K
R130
C130
R131 240
C129
R132 120
R133 715
R134
R135 120
RV129 1K
R129 68
R136 33
R137 75
R128 10.7K
TR106 2SC1906
R140 10K
R147 330
C147 33P
R144 3.3K
R143
RV144
R142
CV142
R141
R145 3.3K
R146 220
TR107 2SC1906
C154 5P
R154 33
R150 100
R148 330
B1
B2
+4.8V
+4.1V
+2.4V
R163 470
R162 2.2K
R164 470
TR113
TR111
TR112
TR114
R152 1.15KF
RV151 1K
R153 1.15KF
C16P 1000P
C162 1000P
D213
D211
D212
D214
TR301-B
TR302-B
D211~14 : 1S2075K
TR111~14 : 2SA836D
TR211
TR212
TR213 2SC458C
R223 150
R224 50
R211 330
C211 1000P
R217 4.7
R219 220
R214 2.2K
-12
+4.8
+3.5
PJ 203
PREAMPLIFIER

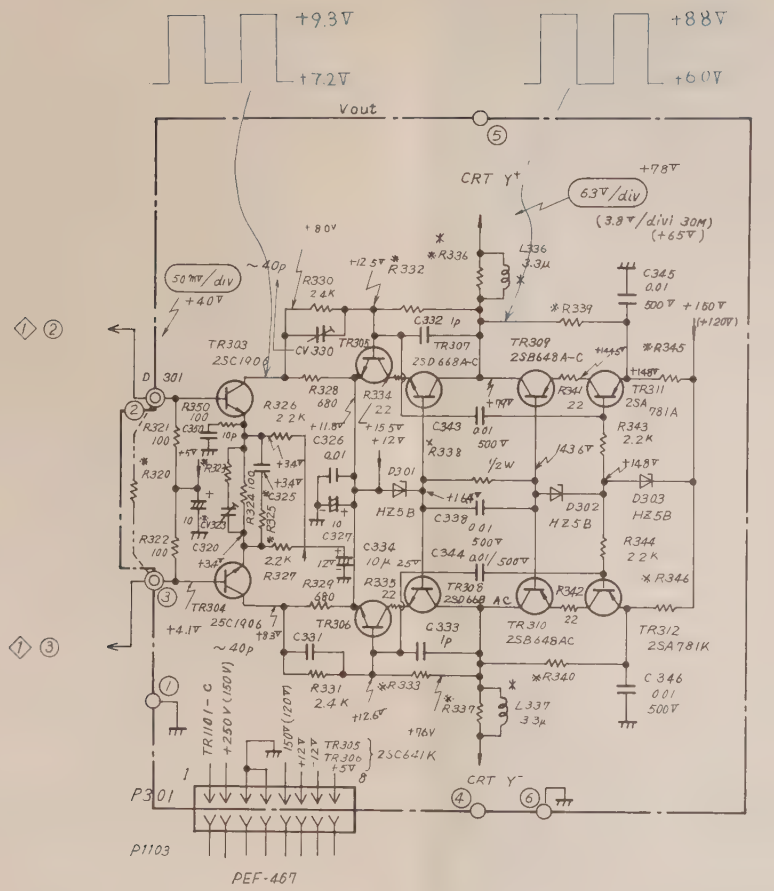


PEF-468

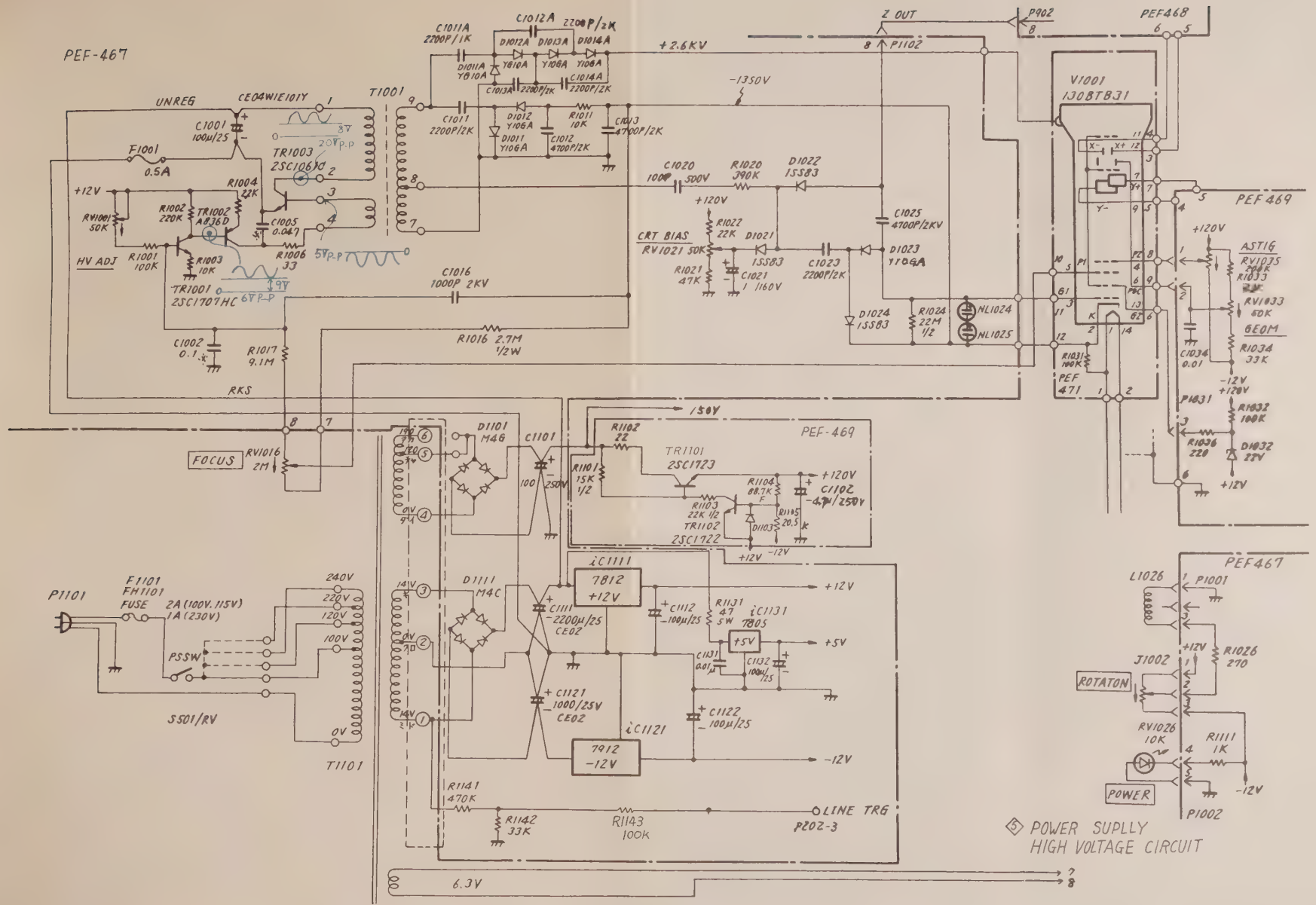
FOR THE DUAL TRACE OSCILLOSCOPE

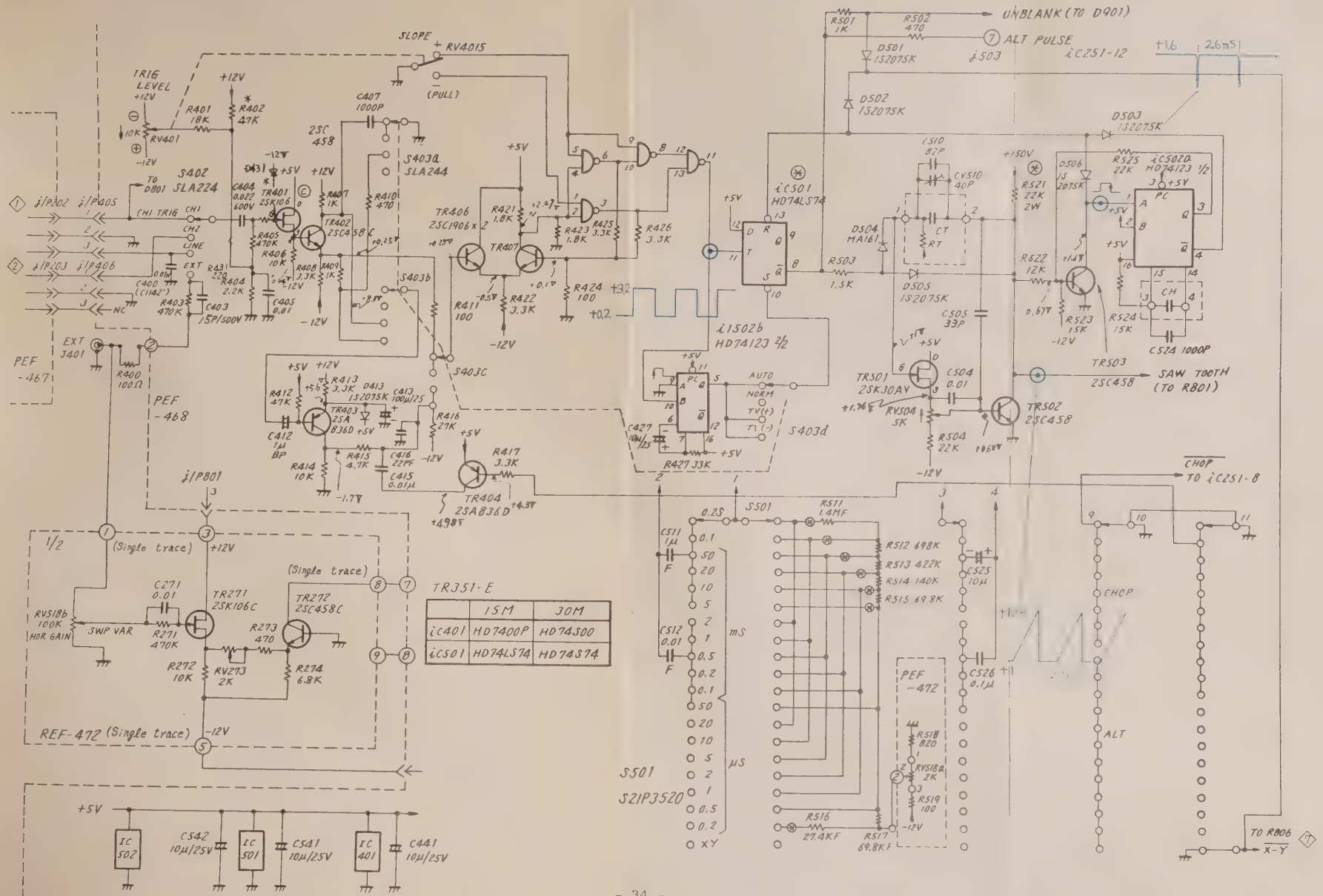
③ VERTICAL SWITCHING


+0.5V
0V
CH2 ORY
J101
PEF 47
TR101-103
TR105 2SC458C
TR106 2SC1956
TR140
TR213 2SC458C
HA17741PS
+12V
+4.1V
+4.8V
+3.5V
0.71V
0.76V
D211~14 1S2075K
TR111~14 2SA836D
FOR THE SINGLE TRACE OSCILLO SCOPE
② CH2 PREAMPLIFIER

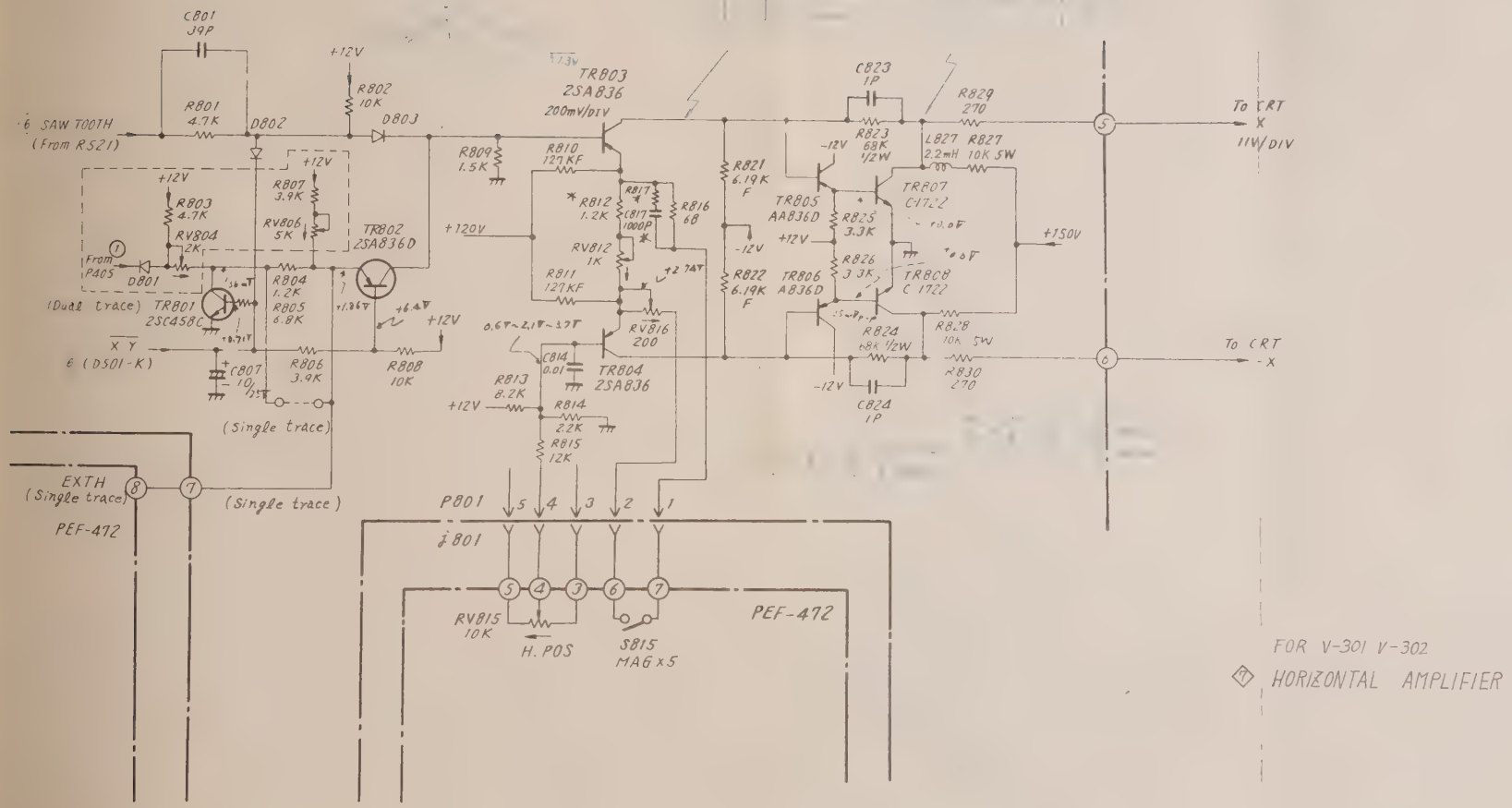


④ VERTICAL OUTPUT AMPLIFIER


PEF-467
UNREG
CE04W1E101Y
T1001
C1001 100μ/25
F1001 0.5A
TR1003 2SC1061C
R1004 22K
+12V
RV1001 50K
R1002 220K
TR1002 A836D
C1005 0.047
HV ADJ
R1001 100K
R1003 10K
R1006 33
TR1001 2SC1707HC
C1002 0.1
R1017 9.1M
RKS
FOCUS
RV1016 2M
C1011A 2200P/1K
C1012A 2200P/2K
D1012A D1013A D1014A
D1011A Y610A
Y610A Y106A Y106A
C1013A 2200P/2K
C1014A 2200P/2K
C1011 2200P/2K
D1012 Y106A
D1011 Y106A
R1011 10K
C1012 4700P/2K
C1013 4700P/2K
+2.6KV
-1350V
C1020 1000P 500V
R1020 390K
D1022 1SS83
+120V
R1022 22K
CRT BIAS RV1021 50K
D1021 1SS83
R1021 47K
C1021 1 /160V
C1023 2200P/2K
C1025 4700P/2KV
D1023 Y106A
D1024 1SS83
R1024 22M 1/2
NL1024
NL1025
C1016 1000P 2KV
R1016 2.7M 1/2W
Z OUT
P902
P1102
PEF468
V1001 130BTB31
X- X+ Y+ Y-
PEF469
+120V
AST16
RV1035 2M
R1033
RV1033 50K
6E0M
C1034 0.01
R1034 33K
-12V +120V
P1031
R1032 100K
R1036 220
D1032 22V
+12V
PEF 471
R1031 100K
D1101 M46
C1101
100 250V
/50V
R1102 22
TR1101 2SC1723
R1101 15K 1/2
R1104 88.7K F
R1103 22K 1/2
TR1102 2SC1722
R1105 20.5K
D1103
C1102 4.7μ/250V
+120V
PEF-469
+12V -12V
D1111 M4C
C1111 2200μ/25 CE02
IC1111 7812 +12V
C1112 100μ/25
R1131 47 5W
IC1131 7805
+5V
C1131 0.01μ
C1132 100μ/25
C1121 1000/25V CE02
IC1121 7912 -12V
C1122 100μ/25
R1141 470K
R1142 33K
R1143 100K
LINE TRG
P202-3
6.3V
P1101
F1101 FH1101 FUSE 2A(100V.115V) 1A(230V)
PSSW
S501/RV
T1101
240V 220V 120V 100V 0V
14V 4V 4V 14V
PEF467
L1026
P1001
+12V
R1026 270
J1002
ROTATON
RV1026 10K
R1111 1K
POWER
-12V
P1002
⑤ POWER SUPLLY
HIGH VOLTAGE CIRCUIT
i/P1104

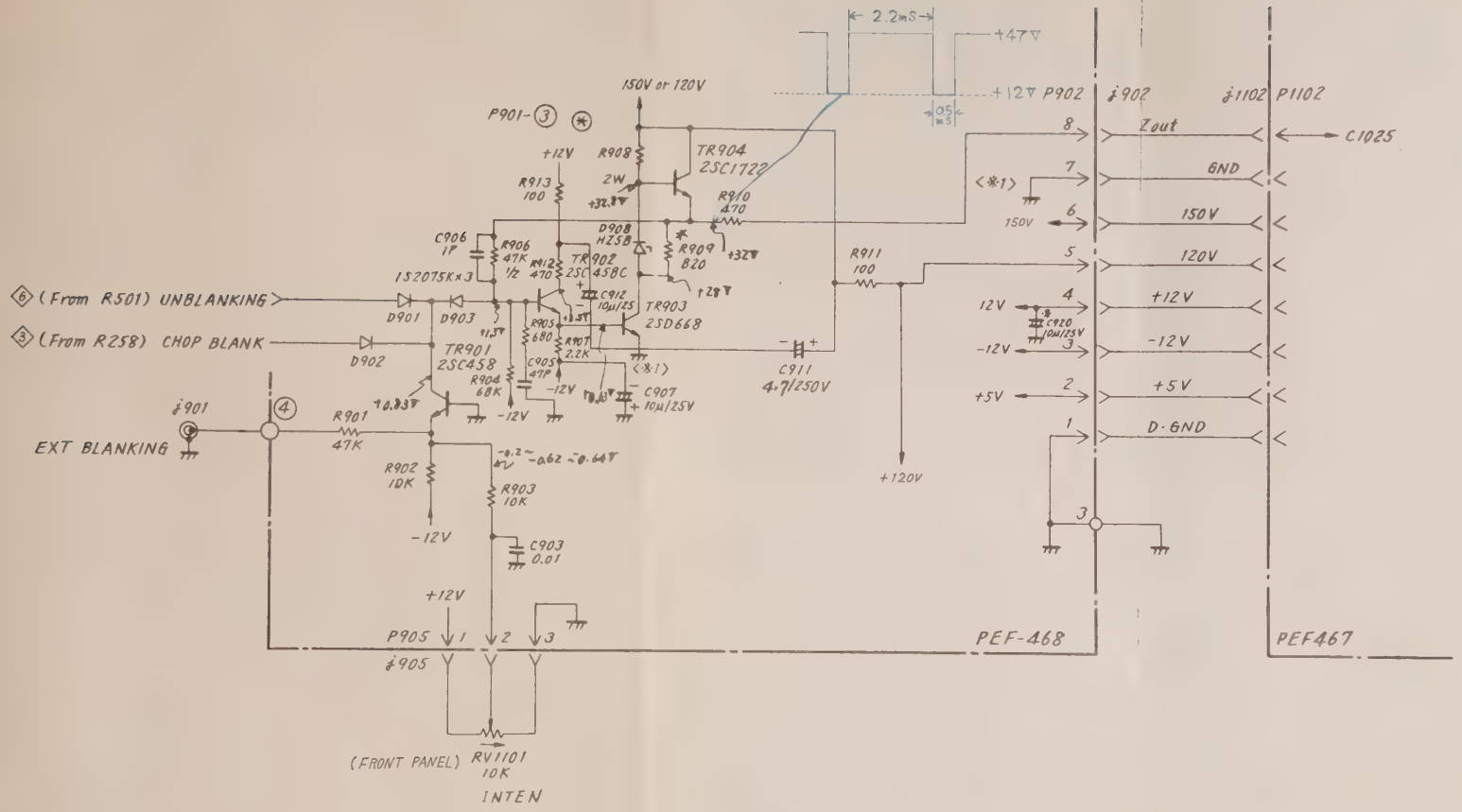


⑥ SWEEP GENERATOR & TRIG



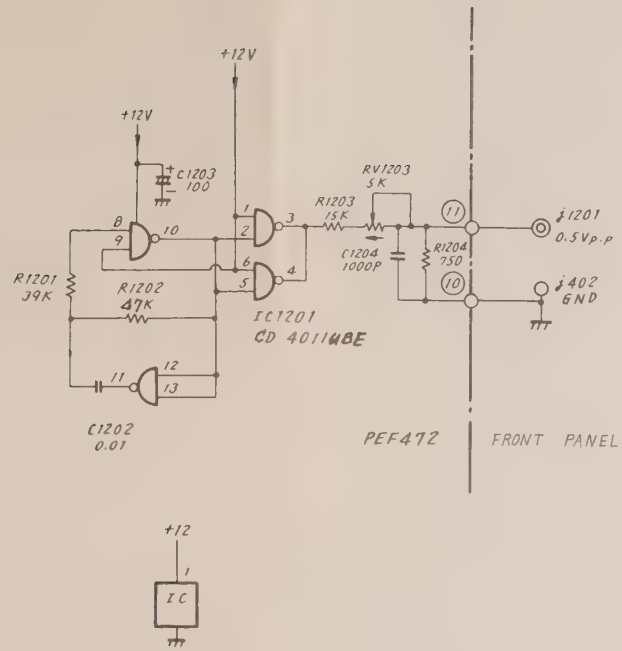
FOR V-301 V-302

⑦ HORIZONTAL AMPLIFIER



FOR V-301, V-302

⑧ Z AXIS AMPLIFIER



◈9 CALIBRATOR

ELECTRICAL REPLACEABLE PARTS LIST

CIRCUIT BOAD(PEF-467)

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
C2	C,CERAMIC 50 V 100 PF+-10%	CCC1325		1		1
C4	C,CERAMIC 50 V 10 PF+-0.5%	CCC1310		1		1
C5	C,MICA 100 V 680 PF+-5%	CMD0358		1		1
C8	C,CERAMIC 500 V 0.01 PF+-10%	CCD0218		1		1
C9	C,CERAMIC 50 V 1000 PF+80-20%	CCC1336		1		1
C13	C,PLASTIC 50 V 0.01 UF+-10%	CQA0077		1		1
C16	C,CERAMIC 50 V 3 PF+-0.25%	CCC1303		1		1
C20	C,CERAMIC 50 V 39 PF+-5%	CCC1317				1
C21	C,AL ELYC 25 V 10 UF	CET0020		1		1
C22	C,AL ELYC 25 V 10 UF	CCC1325		1		1
C23	C,MICA 50 V 100 PF+-10%	0000000		1		1
C25	C,CERAMIC 50 V 1000 PF+80-20%	CCC1336		1		1
C26	C,AL ELYC 25 V 10 UF	CET0020		1		1
C30	C,CERAMIC 50 V 10 PF+-0.5%	CCC1310				1
C47	C,CERAMIC 50 V 33 PF+-5%	CCC1316				1
C55	C,CERAMIC 50 V 1000 PF+80-20%	CCC1336		1		1
CV1	C,VARIABLE ECV-1ZW10×60	CVE0025		1		1
CV2	C,VARIABLE ECV-1ZW10×60	CVE0025		1		1
CV3	C,VARIABLE ECV-1ZW10×60	CVE0025		1		1
CV4	C,VARIABLE ECV-1ZW10×60	CVE0025		1		1
CV42	C,VARIABLE ECV-1ZW40×60	CVE0027				1
C66	C,AL ELYC 25 V 10 UF	CET0020		1		1
C67	C,AL ELYC "	CET0020	1	1	1	1
C73	C,PLASTIC 50 V 0.001 UF+-10%	CQA0071		1		1
TR1	TRANSISTOR 2SK30AY	HTK0011		1		1
TR2	TRANSISTOR E412S-A	HTE0004		1		1
TR3	TRANSISTOR 2SC1674K	HTC0557		1		1
TR4	TRANSISTOR 2SC1674K	HTC0557		1		1
TR5	TRANSISTOR 2SC458C	HTC0148		1		1
TR6	TRANSISTOR 2SC1906	HTC0338		1		1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
TR7	TRANSISTOR 2SC1906	HTC0338		1		1
TR8	TRANSISTOR 2SA836D	HTA0105		1		1
TR9	TRANSISTOR 2SA836D	HTA0105		1		1
TR3	CORE L1-RH0303	HX841221		1		1
TR4	" "			1		1
IC1	ANALOG IC HA17741PS	ILH0088		1		1
R1	R,METAL 1/2W 909 KOHM +-1%	RMR3246		1		1
R2	R,METAL 1/4W 113 KOHM +-1%	RME0633		1		1
R3	R,METAL 1/2W 990 KOHM +-1%	RMR0082		1		1
R4	R,CARBON 1/4W 100 OHM +-5%	RCR4321		1		
R5	R,METAL 1/4W 10 KOHM +-1%	RME0576		1		1
R6	R,METAL 1/2W 1 MOHM +-1%	RMR0204		1		1
R7	R,CARBON 1/4W 220 KOHM +-5%	RCR4361		1		1
R8	R,CARBON 1/4W 220 OHM +-5%	RCR4325		1		1
R9	R,METAL 1/4W 475 OHM +-1%	RME0560		1		1
R10	R,METAL 1/4W 412 OHM +-1%	RME0626		1		1
R12	R,CARBON 1/4W 4.7 KOHM +-5%	RCR4341		1		1
R13	" 1/4W 1.5 KOHM +-5%	RCR4335		1		1
R14	" 1/4W 3.3 KOHM +-5%	RCR4339		1		1
R15	" 1/4W 150 OHM +-5%	RCR4323		1		1
R16	" 1/4W 2.2 KOHM +-5%	RCR4337		1		1
R17	" 1/4W 3.3 KOHM +-5%	RCR4339		1		1
R18	" 1/4W 2.2 KOHM +-5%	RCR4337		1		1
R19	" 1/4W 560 OHM +-5%	RCR4330		1		1
R20	" 1/4W 22 OHM +-5%	RCR4313				1
R21	" " " "	RCR4313		1		1
R22	" 1/4W 22 OHM +-5%	RCR4313		1		1
R23	" 1/4W 22 KOHM +-5%	RCR4349		1		1
R24	" 1/4W 6.19 KOHM +-1%	RME0622		1		1
R25	R,CARBON 1/4W 470 OHM +-5%	RCR4329		1		1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R4	R,CARBON 1/4W 820 OHM +-5%	RCR3050				1
L4	COIL FL-3H 1ROM	TLF0054				1
R26	R,CARBON 1/4W 1.5 KOHM +-5%	RCR4335		1		1
R27	R,METAL 1/4W 71.5 KOHM +-1%	RME0627		1		1
R28	R,METAL 1/4W 10.7 KOHM +-1%	RME0628		1		1
R29	R,CARBON 1/4W 680 OHM +-5%	RCR4331		1		1
R30	R,CARBON 1/4W 1 KOHM +-5%	RCR4333		1		1
R31	R,METAL 1/4W 240 OHM +-1%	RME0629		1		1
R32	" 1/4W 120 OHM +-1%	RME0619		1		1
R33	" 1/4W 71.5 OHM +-1%	RME0630		1		1
R34	" 1/4W 47.5 OHM +-1%	RME0548		1		1
R35	R,CARBON 1/4W 120 OHM +-5%	RCR4322		1		1
R36	" 1/4W 33 OHM +-5%	RCR4315		1		1
R37	" 1/4W 75 OHM +-5%	RCR3025		1		1
R38	" 1/4W 47 OHM +-5%	RCR4317		1		1
R40	" 1/4W 10 KOHM +-5%	RCR4345		1		1
R41	" 1/4W 150 OHM +-5%	RCR4323		1		
R41	" 1/4W 120 OHM +-5%	RCR4322				1
R42	" 1/4W 22 OHM +-5%	RCR4313				1
R43	" 1/4W 68 OHM +-5%	RCR4319				1
R43	" 1/4W 82 OHM +-5%	RCR4320		1		
R44	" 1/4W 2.7 KOHM +-5%	RCR4338		1		1
R45	" 1/4W 2.7 KOHM +-5%	RCR4338		1		1
R47	" 1/4W 330 OHM +-5%	RCR4327		1		1
R48	" 1/4W 330 OHM +-5%	RCR4327		1		1
R49	" 1/4W 100 OHM +-5%	RCR4321		1		1
R50	" 1/4W 100 OHM +-5%	RCR4321		1		1
R51	" 1/4W 2.2 KOHM +-5%	RCR4337		1		1
R52	R,METAL 1/4W 1.15 KOHM +-1%	RME0620		1		1
R53	" 1/4W 1.15 KOHM +-1%	RME0620		1		1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R54	R,CARBON 1/4W 470 OHM +-5%	RCR4329		1		1
R55	" 1/4W 2.2 KOHM +-5%	RCR4337		1		1
P2	CONNECTOR 171825-3	JBX0468		1		1
R72	R,CARBON 1/4W 39 OHM +-5%	RCR4316		1		1
R73	" 1/4W 6.8 OHM +-5%	RCR4307		1		1
RV11	VR,CARBON EVL-SOAA00B22	RDE0012		1		1
		HX8311711		R		R
		HX8311704		R		R
RV16	VR,CARBON EVL-SOAA00B52	RDE0010		1		1
		HX8311711		R		R
		HX8311704		R		R
RV18	VR,CARBON EVL-SOAA00B22	RDE0012		1		1
		HX8311711		R		R
		HX8311704		R		R
RV29	VR,CARBON EVH-CCAK20B13	RDE0011		1		1
		H 8311707		R		R
		H 8311702		R		R
RV43	VR,CARBON EVL-SOAA00B22	RDE0012		1		1
		HX8311711		R		R
		HX8311704		R		R
RV44	VR,CARBON EVL-SOAA00B23	RDE0015		1		1
		HX8311711		R		R
		HX8311704		R		R
RV51	VR,CARBON EVH-Y13K20B13	RDE0013		1		1
		HX8311705		R		R
		H 8311701		R		R
S2	SW,ROTARY S21P2310	HX8311685		1		1
		HX8311686		R		R
C102	C,CERAMIC 50 V 100 PF+-10%	CCC1325	1	1	1	1
C104	C,CERAMIC 50 V 10 PF+-0.5%	CCC1310	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
C105	C,MICA 100 V 680 PF+-5%	CMD0358	1	1	1	1
C108	C,CERAMIC 500 V 0.01 PF+-10%	CCD0218	1	1	1	1
C109	" 50 V 1000 PF+80-20%	CCC1336	1	1	1	1
C113	C,PLASTIC 50 V 0.01 UF+-10%	CQA0077	1	1	1	1
C116	C,CERAMIC 50 V 8 PF+-0.25%	CCC1303	1	1	1	1
C120	" 50 V 33 PF+-5%	CCC1316			1	1
C121	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C122	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C123	C,CERAMIC 50 V 100 PF+-10%	CCC1325	1	1	1	1
C125	" 50 V 1000 PF+80-20%	CCC1336	1	1	1	1
C126	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C130	C,CERAMIC 50 V 10 PF+-0.5%	CCC1310			1	1
C147	" 50 V 33 PF+-5%	CCC1316			1	1
C154	" 50 V 5 PF+-0.25%	CCC1305	1	1	1	1
C161	" 50 V 1000 PF+80-20%	CCC1336		1		1
C162	" 50 V 1000 PF+80-20%	CCC1336	1	1	1	1
C173	C,PLASTIC 50 V 0.001 UF+-10%	CQA0071	1	1	1	1
CV101	C,VARIABLE ECV-1ZW10 × 60	CVE0025	1	1	1	1
CV102	" ECV-1ZW10 × 60	CVE0025	1	1	1	1
CV103	" ECV-1ZW10 × 60	CVE0025	1	1	1	1
CV104	" ECV-1ZW10 × 60	CVE0025	1	1	1	1
CV142	" ECV-1ZW40 × 60	CVE0027			1	1
TR101	TRANSISTOR 2SK30AY	HTK0011	1	1	1	1
TR102	" E412S-A	HTE0004	1	1	1	1
TR103	" 2SC1674K	HTC0557	1	1	1	1
TR104	" 2SC1674K	HTC0557	1	1	1	1
TR105	" 2SC458C	HTC0148	1	1	1	1
TR106	" 2SC1906	HTC0338	1	1	1	1
TR107	" 2SC1906	HTC0338	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
TR103	CORE L1-RH0303	HX841221	1	1	1	1
TR104	" "	"	1	1	1	1
TR111	TRANSISTOR 2SA836D	HTA0105		1		1
TR112	" 2SA836D	HTA0105		1		1
TR113	" 2SA836D	HTA0105	1	1	1	1
TR114	" 2SA836D	HTA0105	1	1	1	1
IC101	ANALOG IC HA17741PS	ILH0088	1	1	1	1
R101	R,METAL 1/2W 909 KOHM +-1%	RMR3246	1	1	1	1
R102	R,METAL 1/4W 113 KOHM +-1%	RME0633	1	1	1	1
R103	R,METAL 1/2W 990 KOHM +-1%	RMR0082	1	1	1	1
R104	R,CARBON 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
R105	R,METAL 1/4W 10 KOHM +-1%	RME0576	1	1	1	1
R106	" 1/2W 1 KOHM +-1%	RMR0204	1	1	1	1
R107	R,CARBON 1/4W 220 KOHM +-5%	RCR4361	1	1	1	1
R108	" 1/4W 220 OHM +-5%	RCR4325	1	1	1	1
R109	R,METAL 1/4W 475 OHM +-1%	RME0560	1	1	1	1
R110	" 1/4W 412 OHM +-1%	RME0626	1	1	1	1
R112	R,CARBON 1/4W 4.7 KOHM +-5%	RCR4341	1	1	1	1
R113	" 1/4W 1.5 KOHM +-5%	RCR4335	1	1	1	1
R114	" 1/4W 3.3 KOHM +-5%	RCR4339	1	1	1	1
R115	" 1/4W 150 OHM +-5%	RCR4323	1	1	1	1
R116	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R117	" 1/4W 3.3 KOHM +-5%	RCR4339	1	1	1	1
R118	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R119	" 1/4W 560 OHM +-5%	RCR4330	1	1	1	1
R120	" 1/4W 22 OHM +-5%	RCR4313	1	1	1	1
R121	" 1/4W 22 OHM	RCR4313	1	1	1	1
R122	" 1/4W 22 OHM +-5%	RCR4313	1	1	1	1
R123	" 1/4W 22 KOHM +-5%	RCR4349	1	1	1	1
R124	" 1/4W 6.19 KOHM +-1%	RME0622	1	1	1	1

Symbol	Description					Code	Qty			
							V-151	V-152	V-301	V-302
R125	R,CARBON	1/4W	470	OHM	+-5%	RCR4329	1	1	1	1
R126	"	1/4W	1.5	KOHM	+-5%	RCR4335	1	1	1	1
R127	R,METAL	1/4W	71.5	KOHM	+-1%	RME0627	1	1	1	1
R128	"	1/4W	10.7	KOHM	+-1%	RME0628	1	1	1	1
R129	R,CARBON	1/4W	680	OHM	+-5%	RCR4331	1	1	1	1
R130	"	1/4W	1	KOHM	+-5%	RCR4333	1	1	1	1
R131	R,METAL	1/4W	240	OHM	+-1%	RME0629	1	1	1	1
R132	"	1/4W	120	OHM	+-1%	RME0619	1	1	1	1
R133	"	1/4W	71.5	OHM	+-1%	RME0630	1	1	1	1
R134	"	1/4W	47.5	OHM	+-1%	RME0548	1	1	1	1
R135	R,CARBON	1/4W	120	OHM	+-5%	RCR4322	1	1	1	1
R136	"	1/4W	33	OHM	+-5%	RCR4315	1	1	1	1
R137	"	1/4W	75	OHM	+-5%	RCR3025	1	1	1	1
R138	"	1/4W	47	OHM	+-5%	RCR4317	1	1	1	1
R140	"	1/4W	10	KOHM	+-5%	RCR4345	1	1	1	1
R141	"	1/4W	150	OHM	+-5%	RCR4323	1	1		
R141	"	1/4W	120	OHM	+-5%	RCR4322			1	1
R142	"	1/4W	22	OHM	+-5%	RCR4313			1	1
R143	"	1/4W	68	OHM	+-5%	RCR4319			1	1
R143	"	1/4W	82	OHM	+-5%	RCR4320	1	1		
R144	"	1/4W	2.7	KOHM	+-5%	RCR4338	1	1	1	1
R145	"	1/4W	2.7	KOHM	+-5%	RCR4338	1	1	1	1
R147	"	1/4W	330	OHM	+-5%	RCR4327	1	1	1	1
R148	"	1/4W	330	OHM	+-5%	RCR4327	1	1	1	1
R149	"	1/4W	100	OHM	+-5%	RCR4321	1	1	1	1
R150	"	1/4W	100	OHM	+-5%	RCR4321	1	1	1	1
R151	"	1/4W	2.2	KOHM	+-5%	RCR4337	1	1	1	1
R152	R,METAL	1/4W	1.15	KOHM	+-1%	RME0620	1	1	1	1
R153	"	1/4W	1.15	KOHM	+-1%	RME0620	1	1	1	1
R154	R,CARBON	1/4W	33	OHM	+-5%	RCR4315	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R161	R,CARBON 1/4W 2.2 KOHM +-5%	RCR4337		1		1
R162	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R163	" 1/4W 470 OHM +-5%	RCR4329		1		1
R164	" 1/4W 470 OHM +-5%	RCR4329	1	1	1	1
R172	" 1/4W 39 OHM +-5%	RCR4316	1	1	1	1
R173	" 1/4W 6.8 OHM +-5%	RCR4307	1	1	1	1
P102	CONNECTOR 171825-3	JBX0468	1	1	1	1
RV111	VR,CARBON EVL-SOAA00B22	RDE0012	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
RV116	VR,CARBON EVL-SOAA00B52	RDE0010	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
RV118	VR,CARBON EVL-SOAA00B22	RDE0012	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
RV129	VR,CARBON EVH-CCAK20B13	RDE0011	1	1	1	1
		H 8311707	R	R	R	R
		H 8311702	R	R	R	R
RV143	VR,CARBON EVL-SOAA00B22	RDE0012	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
RV144	VR,CARBON EVL-SOAA00B23	RDE0015	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
RV151	VR,CARBON EVH-Y13K20B13	RDE0013	1	1	1	1
		H×8311705	R	R	R	R
		H 8311701	R	R	R	R
S102	SW,ROTARY S21P2310	HX8311685	1	1	1	1
		HX8311686	R	R	R	R

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
D201	DIODE 1S2075K T-D	HDS0331		1		1
D202	" 1S2075K T-D	HDS0331		1		1
D203	" 1S2075K T-D	HDS0331		1		1
D204	" 1S2075K T-D	HDS0331		1		1
D211	" 1S2075K T-D	HDS0331		1		1
D212	" 1S2075K T-D	HDS0331		1		1
D213	" 1S2075K T-D	HDS0331	1	1	1	1
D214	" 1S2075K T-D	HDS0331	1	1	1	1
TR201	TRANSISTOR 2SA781K	HTA0099				1
TR202	" 2SA781K	HTA0099				1
TR203	" 2SC458C	HTC0148		1		1
TR201	" 2SA836D	HTA0105		1		
TR202	" 2SA836D	HTA0105		1		
TR211	" 2SA781K	HTA0099			1	1
TR212	" 2SA781K	HTA0099			1	1
TR213	" 2SC458C	HTC0148	1	1	1	1
TR211	" 2SA836D	HTA0105	1	1		
TR212	" 2SA836D	HTA0105	1	1		
IC201	DIGITAL IC HD74LS74P	IDH0626	1	1	1	1
P201	CONNECTOR 171825-3	JBX0468		1		1
P202	" 171825-3	JBX0468		1		1
P203	" 171825-3	JBX0468	1	1	1	1
C201	C,CERAMIC 50 V 15 PF +-5%	CCC1312				1
C211	" 50 V 15 PF +-5%	CCC1312			1	1
R201	R,CARBON 1/4W 330 OHM +-5%	RCR4327		1		1
R202	" 1/4W 2.4 KOHM +-5%	RCR3061		1		1
R203	" 1/4W 2.4 KOHM +-5%	RCR3061		1		1
R204	" 1/4W 2.2 KOHM +-5%	RCR4337		1		1
R205	" 1/4W 1 KOHM +-5%	RCR4333		1		1
R206	" 1/4W 680 OHM +-5%	RCR4331		1		1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R207	R,CARBON 1/4W 47 OHM +-5%	RCR4317		1		1
R208	" 1/4W 100 OHM +-5%	RCR4321		1		1
R209	" 1/4W 220 OHM +-5%	RCR4325		1		1
R211	" 1/4W 330 OHM +-5%	RCR4327	1	1	1	1
R212	" 1/4W 2.4 KOHM +-5%	RCR3061	1	1	1	1
R213	" 1/4W 2.4 KOHM +-5%	RCR3061	1	1	1	1
R214	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R215	" 1/4W 1 KOHM +-5%	RCR4333	1	1	1	1
R216	" 1/4W 680 OHM +-5%	RCR4331	1	1	1	1
R217	" 1/4W 47 OHM +-5%	RCR4317	1	1	1	1
R218	" 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
R219	" 1/4W 220 OHM +-5%	RCR4325	1	1	1	1
R221	" 1/4W 150 OHM +-5%	RCR4323		1		1
R222	" 1/4W 150 OHM +-5%	RCR4323		1		1
S201	SW,LEVER SLA245	SSL0053		1		1
R223	R,CARBON 1/4W 150 OHM +-5%	RCR4323	1	1	1	1
R224	" 1/4W 150 OHM +-5%	RCR4323	1	1	1	1
R265	" 1/4W 470 OHM +-5%	RCR4329		1		1
R301	" 1/4W 330 OHM +-5%	RCR4327	1	1	1	1
R302	" 1/4W 470 OHM +-5%	RCR4329	1	1	1	1
R303	" 1/4W 3.3 KOHM +-5%	RCR4339		1		1
R304	" 1/4W 3.3 KOHM +-5%	RCR4339		1		1
R305	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R306	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R307	" 1/4W 330 OHM +-5%	RCR4327	1	1	1	1
R308	" 1/4W 470 OHM +-5%	RCR4329	1	1	1	1
R309	" 1/4W 39 KOHM +-5%	RCR4352	1	1		
R310	" 1/4W 47 OHM +-5%	RCR4317	1	1		
R311	" 1/4W 1.5 KOHM +-5%	RCR4335	1	1	1	1
R312	" 1/4W 1.5 KOHM +-5%	RCR4335	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R313	R,CARBON 1/4W 91 OHM +-5%	RCR3027	1	1	1	1
R314	" 1/4W 91 OHM +-5%	RCR3027	1	1	1	1
R315	" 1/2W 560 OHM +-5%	RCR3153	1	1	1	1
R316	" 1/4W 470 OHM +-5%	RCR4329	1	1		
TR301	TRANSISTOR 2SC1906	HTC0338	1	1	1	1
TR302	" 2SC1906	HTC0338	1	1	1	1
CV316	C,VARIABLE ECV-1ZW20 × 60	CVE0026	1	1	1	1
C309	C,CERAMIC 50 V 220 PF +-1%	CCC1329	1	1		
C309	C,PLASTIC 50 V 0.01 UF +-10%	CQA0077			1	1
C310	C,CERAMIC 50 V 22 PF +-5%	CCC1314			1	1
C310	C,CERAMIC 50 V 10 PF +-0.5%	CCC1310	1	1		
R309	R,CARBON 1/4W 68 KOHM +-5%	RCR4355			1	1
R310	R,CARBON 1/4W 27 KOHM +-5%	RCR4350			1	1
R316	R,CARBON 1/4W 680 OHM +-5%	RCR4331			1	1
C1001	C,AL ELYC 25 V 100 UF	CEC0177	1	1	1	1
C1002	C,PLASTIC 50 V 0.33 UF +-10%	CQA0018	1	1	1	1
C1005	C,PLASTIC 50 V 0.047 UF +-10%	CQA0081	1	1	1	1
C1011	C,CERAMIC 2 KV 2200 PF +-10%	CCD0219	1	1	1	1
C1012	" 2 KV 4700 PF +-10%	CCD0221	1	1	1	1
C1013	" 2 KV 4700 PF +-10%	CCD0221	1	1	1	1
C1011A	" 2 KV 2200 PF +-10%	CCD0219			1	1
C1012A	" 2 KV 2200 PF +-10%	CCD0219			1	1
C1013A	" 2 KV 2200 PF +-10%	CCD0219			1	1
C1014A	" 2 KV 2200 PF +-10%	CCD0219			1	1
C1016	" 2 KV 1000 PF +-10%	CCD0220	1	1	1	1
C1020	" 500 V 1000 PF +-10%	CCD0217	1	1	1	1
C1021	C, AL ELYC 160 V 1 UF	CEC0213	1	1	1	1
C1023	C,CERAMIC 2 KV 2200 PF +-10%	CCD0219	1	1	1	1
C1025	C,CERAMIC 2 KV 4700 PF +-10%	CCD0221	1	1	1	1
D1011	DIODE Y10GA	HDY0031	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
D1012	DIODE Y10GA	HDY0031	1	1	1	1
D1011A	DIODE Y10GA	HDY0031			1	1
D1012A	DIODE Y10GA	HDY0031			1	1
D1013A	DIODE Y10GA	HDY0031			1	1
D1014A	DIODE Y10GA	HDY0031			1	1
D1021	DIODE 1SS83	HDS0250	1	1	1	1
D1022	DIODE 1SS83	HDS0250	1	1	1	1
D1023	DIODE Y10GA	HDY0031	1	1	1	1
D1024	DIODE Y10GA	HDY0031	1	1	1	1
F1001	FUSE FR-11 125V DIA6.3×8.7 0.5A	EFL0012	1	1	1	1
TR1001	TRANSISTOR 2SC1707HC	HTC0322	1	1	1	1
TR1002	" 2SA836D	HTA0105	1	1	1	1
TR1003	" 2SC1061C	HTC0032	1	1	1	1
NL1024	LAMP NE-2	ELL0019	1	1	1	1
NL1025	LAMP NE-2	ELL0019	1	1	1	1
R1001	R,METAL 1/4W 82.5 KOHM +-1%	RME0587	1	1		
R1001	" 1/4W 100 KOHM +-1%	RME0588			1	1
R1002	R,CARBON 1/4W 220 KOHM +-5%	RCR4361	1	1	1	1
R1003	" 1/4W 10 KOHM +-5%	RCR4345	1	1	1	1
R1004	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R1006	" 1/4W 33 OHM +-5%	RCR4315	1	1	1	1
R1011	" 1/4W 10 KOHM +-5%	RCR3076	1	1	1	1
R1016	" 1/2W 1.8 MOHM +-5%	RCR3476	1	1		
R1017	" 2 W 12 MOHM +-5%	RCR4171	1	1		
R1017	" 2 W 9.1 MOHM +-5%	RCR4172			1	1
R1016	" 1/2W 2.7 MOHM +-5%	RCR3480			1	1
R1020	" 1/4W 390 KOHM +-5%	RCR3426	1	1	1	1
R1021	" 1/4W 47 KOHM +-5%	RCR4353	1	1	1	1
R1022	" 1/4W 33 KOHM +-5%	RCR4351	1	1		
R1022	" 1/4W 22 KOHM +-5%	RCR4349			1	1

Symbol	Description	Code	Qty			
			V-151	V-)52	V-301	V-302
R1024	R,SOLID 1/2W 22 MOHM +-5%	RSR0420	1	1	1	1
R1026	R,CARBON 1/4W 270 OHM +-5%	RCR4326	1	1	1	1
RV1001	VR,CARBON EVL-SOAA00B54 50K OHM	RDE0017	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
RV1021	VR,CARBON EVT-SOAA00B54	RDE0018	1	1	1	1
		HX8311713	R	R	R	R
		HX8311704	R	R	R	R
P1001	CONNECTOR 171825-3	JBX0468	1	1	1	1
P1002	" 171825-6	JBX0470	1	1	1	1
T1001	XFMR	HX8311682	1	1	1	1
C1101	C,AL ELYC 350 V 47 UF	CEC0142	1	1		
C1101	C,AL ELYC 250 V 100 UF	CEC0433			1	1
C1111	C,AL ELYC 25 V 2200 UF	CEC0347	1	1	1	1
C1112	C,AL ELYC 25 V 100 UF	CEC0177	1	1	1	1
C1121	C,AL ELYC 25 V 1000 UF	CEC0178	1	1	1	1
C1122	C,AL ELYC 25 V 100 UF	CEC0177	1	1	1	1
C1131	C,CERAMIC 50 V 10000 PF	CCC1339	1	1	1	1
C1132	C,AL ELYC 25 V 100 UF	CEC0177	1	1	1	1
D1101	DIODE M4G-1	HDM0034	1	1	1	1
D1111	DIODE M4C-1	HDM0033	1	1	1	1
IC1111	DIGITAL IC UA7812UC	IDM0318	1	1	1	1
IC1121	DIGITAL IC UA7912UC	IDM0319	1	1	1	1
IC1131	DIGITAL IC UA7805UC	IDM0320	1	1	1	1
P1102	CONNECTOR 171825-8	JBX0467	1	1	1	1
P1103	" 171825-8	JBX0467	1	1	1	1
P1104	" 163685-4	JBX0469	1	1	1	1
R1102	R,METAL 5 W 820 OHM +-5 %	RMR3229	1	1		
R1102	R,CARBON 1/4W 22 OHM +-5 %	RCR4313			1	1
R1111	" 1/4W 1 KOHM +-5 %	RCR4333	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R1131	R,METAL 5 W 47 OHM +-5%	RMR2837	1	1	1	1
R1141	R,CARBON 1/4W 470 OHM +-5%	RCR4365	1	1	1	1
R1142	" 1/4W 33 OHM +-5%	RCR4351	1	1	1	1
R1143	" 1/4W 100 KOHM +-5%	RCR4357	1	1	1	1
PEF-467C	PCB	HX116412	1	1	1	1

ELECTRICAL REPLACEABLE PARTS LIST
CIRCUIT BOARD(PEF-468)

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
C251	C,CERAMIC 50 V 220 PF +-10%	CCC1329		1		1
C252	C,PLASTIC 50 V 0.001 UF +-10%	CQA0071		1		1
C253	C,AL ELYC 25 V 10 UF	CET0020		1		1
C256	C,CERAMIC 50 V 220 PF +-10%	CCC1329		1		1
C261	" 50 V 220 PF +-10%	CCC1329		1		1
D251	DiODE 1S2075K T-D	HDS0331		1		1
D252	" 1S2075K T-D	HDS0331		1		1
IC251	DIGITAL IC HD74LS02P	IDH0646		1		1
IC252	" HD7402P	IDH0179		1		1
L261	COIL FL-5H 101K	TLF0067		1		1
R251	R,CARBON 1/4W 270 OHM +-5%	RCR4326		1		1
R252	" 1/4W 2.2 KOHM +-5%	RCR4337		1		1
R256	" 1/4W 680 OHM +-5%	RCR4331		1		1
R257	" 1/4W 27 KOHM +-5%	RCR4350		1		
R257	" 1/4W 15 KOHM +-5%	RCR4347				1
R258	" 1/4W 1.5 KOHM +-5%	RCR4335		1		1
R261	" 1/4W 1 KOHM +-5%	RCR4333		1		1
R262	" 1/4W 27 KOHM +-5%	RCR4350		1		1
P251	CONNECTOR 171825-3	JBX0468		1		1
C403	C,CERAMIC 500 V 15 PF +-10%	CCC0774	1	1	1	1
C404	C,PLASTIC 600 V 22000 PF +-10%	CQX0071	1	1	1	1
C405	C,CERAMIC 50 V 0.01 PF+80-20%	CCC1339	1	1	1	1
C400	" 50 V 0.01 PF+80-20%	CCC1339	1	1	1	1
C407	" 50 V 1000 PF+80-20%	CCC1336	1	1	1	1
C412	C,AL ELYC 50 V 1 UF NP	CEC0391	1	1	1	1
C413	" 25 V 100 UF	CEC0177	1	1	1	1
C415	C,PLASTIC 50 V 0.01 UF +-10%	CQA0077	1	1	1	1
C416	C,CERAMIC 50 V 22 PF +-5%	CCC1314	1	1	1	1
C427	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C441	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
D413	DIODE 1S2075K T-D	HDS0331	1	1	1	1
D431	DIODE 1S2075K T-D	HDS0331	1	1	1	1
TR401	TRANSISTOR 2SK106C	HTK0068	1	1	1	1
TR402	" 2SC458C	HTC0148	1	1	1	1
TR403	" 2SA836D	HTA0105	1	1	1	1
TR404	" 2SA836D	HTA0105	1	1	1	1
TR406	" 2SC1906	HTC0338	1	1	1	1
TR407	" 2SC1906	HTC0338	1	1	1	1
IC401	DIGITAL IC HD7400P	IDH0177	1	1		
IC401	" HD74S00	IDH0402			1	1
R401	R,CARBON 1/4W 18 KOHM +-5%	RCR4348	1	1	1	1
R402	" 1/4W 47 KOHM +-5%	RCR4353	1	1	1	1
R403	" 1/4W 470 KOHM +-5%	RCR4365	1	1	1	1
R404	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R405	" 1/4W 470 KOHM +-5%	RCR4365	1	1	1	1
R406	" 1/4W 10 KOHM +-5%	RCR4345	1	1	1	1
R407	" 1/4W 1 KOHM +-5%	RCR4333	1	1	1	1
R408	" 1/4W 3.3 KOHM +-5%	RCR4339	1	1	1	1
R409	" 1/4W 1 KOHM +-5%	RCR4333	1	1	1	1
R410	" 1/4W 470 OHM +-5%	RCR4329	1	1	1	1
R411	" 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
R412	" 1/4W 47 KOHM +-5%	RCR4353	1	1	1	1
R413	" 1/4W 3.3 KOHM +-5%	RCR4339	1	1	1	1
R414	" 1/4W 10 KOHM	RCR4345	1	1	1	1
R415	" 1/4W 4.7 KOHM +-5%	RCR4341	1	1	1	1
R416	" 1/4W 27 KOHM +-5%	RCR4350	1	1	1	1
R417	" 1/4W 3.3 KOHM +-5%	RCR4339	1	1	1	1
R421	" 1/4W 1.8 KOHM +-5%	RCR4336	1	1	1	1
R422	" 1/4W 3.3 KOHM +-5%	RCR4339	1	1	1	1
R423	" 1/4W 1.8 KOHM +-5%	RCR4336	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R424	R,CARBON 1/4W 100 OHM +-5 %	RCR4321	1	1	1	1
R425	" 1/4W 3.3 KOHM +-5 %	RCR4339	1	1	1	1
R426	" 1/4W 3.3 KOHM +-5 %	RCR4339	1	1	1	1
R427	" 1/4W 33 KOHM +-5 %	RCR4351	1	1	1	1
R431	" 1/4W 220 OHM +-5 %	RCR4325	1	1	1	1
RV401	VR,CARBON EVH-Y13K20B14	RDE0003	1	1	1	1
		HX8311705	R	R	R	R
		HX8311701	R	R	R	R
S402	SW,LEVER SLA224 NON SHORT	SSL0054	1	1	1	1
S403	SW,LEVER SLA244 NON SHORT	SSL0055	1	1	1	1
P405	CONNECTOR 171825-3	JBX0468		1		1
P406	" 171825-3	JBX0468	1	1	1	1
C504	C,CERAMIC 50 V 0.01 UF+80-20 %	CCC1339	1	1	1	1
C505	" 50 V 33 PF+-5%	CCC1316	1	1	1	1
C510	" 50 V 82 PF+-5%	CCC1321	1	1	1	1
C511	C,PLASTIC 100 V 1 UF+-1%	CQT0051	1	1	1	1
C512	" 100 V 0.01 UF+-1%	CQT0052	1	1	1	1
C524	" 50 V 0.001 UF+-10%	CQA0071	1	1	1	1
C525	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C526	C,PLASTIC 50 V 0.1 UF+-10%	CQA0083	1	1	1	1
CV510	C,VARIABLE ECV-1ZW40×60	CVE0027	1	1	1	1
C541	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C542	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
D501	DIODE 1S2075K T-D	HDS0331	1	1	1	1
D502	" 1S2075K T-D	HDS0331	1	1	1	1
D503	" 1S2075K T-D	HDS0331	1	1	1	1
D505	" 1S2075K T-D	HDS0331	1	1	1	1
D504	" MA161	HDM0051	1	1	1	1
D506	" 1S2075K T-D	HDS0331	1	1	1	1
TR501	TRANSISTOR 2SK30AY	HTK0011	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
TR502	TRANSISTOR 2SC458C	HTC0148	1	1	1	1
TR503	" 2SC458C	HTC0148	1	1	1	1
IC501	DIGITAL IC HD74LS74P	IDH0626	1	1		
IC501	" HD74S74	IDH0428			1	1
IC502	" HD74123P	IDH0323	1	1	1	1
R501	R,CARBON 1/4W 1 KOHM +-5%	RCR4333	1	1	1	1
R502	" 1/4W 470 OHM +-5%	RCR4329		1		1
R503	" 1/4W 1.5 KOHM +-5%	RCR4335	1	1	1	1
R504	" 1/4W 22 KOHM +-5%	RCR4349	1	1	1	1
R511	R,METAL 1/2W 1.4 MOHM +-1%	RMR3070	1	1	1	1
R512	" 1/2W 698 KOHM +-1%	RMR3249	1	1	1	1
R513	" 1/4W 422 KOHM +-1%	RME0631	1	1	1	1
R514	" 1/4W 140 KOHM +-1%	RME0625	1	1	1	1
R515	" 1/4W 69.8 KOHM +-1%	RME0632	1	1	1	1
R516	" 1/4W 27.4 KOHM +-1%	RME0621	1	1	1	1
R517	" 1/8W 69.8 KOHM +-1%	RMR3251	1	1	1	1
R521	" 2 W 22 KOHM +-5%	RMR2807	1	1		
R521	" 2 W 15 KOHM +-5%	RMR2806			1	1
R522	R,CARBON 1/4W 12 KOHM +-5%	RCR4346	1	1	1	1
R523	" 1/4W 15 KOHM +-5%	RCR4347	1	1	1	1
R524	" 1/4W 15 KOHM +-5%	RCR4347	1	1	1	1
R525	" 1/4W 22 KOHM +-5%	RCR4349	1	1	1	1
RV504	VR,CARBON EVL-S0AA00B53	RDE0004	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
S501	SW,ROTARY S21P3520	HX8311684	1	1	1	1
		HX8311686	R	R	R	R
C801	C,CERAMIC 50 V 39 PF+-5%	CCC1317	1	1	1	1
C807	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C814	C,CERAMIC 50 V 0.01 UF	CCC1339	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
C817	C,PLASTIC 50 V 0.001 UF+-10%	CQA0071	1	1	1	1
C823	C,CERAMIC 500 V 1 PF+-0.25PF	CCC1353	1	1	1	1
C824	" 500 V 1 PF+-0.25PF	CCC1353	1	1	1	1
D801	DIODE 1S2075K T-D	HDS0331		1		1
D802	" 1S2075K T-D	HDS0331	1	1	1	1
D803	" 1S2075K T-D	HDS0331	1	1	1	1
TR801	TRANSISTOR 2SC458C	HTC0148		1		1
TR802	" 2SA836D	HTA0105	1	1	1	1
TR803	" 2SA836D	HTA0105	1	1	1	1
TR804	" 2SA836D	HTA0105	1	1	1	1
TR805	" 2SA836D	HTA0105	1	1	1	1
TR806	" 2SA836D	HTA0105	1	1	1	1
TR807	" 2SC1722	HTC0514	1	1	1	1
TR808	" 2SC1722	HTC0514	1	1	1	1
L827	COIL FL-7H 222J	TLF0021			1	1
L827	" FL-7H 682J	TLF0148	1	1		
R801	R,CARBON 1/4W 4.7 KOHM+-5%	RCR4341	1	1	1	1
R802	" 1/4W 10 KOHM+-5%	RCR4345	1	1	1	1
R803	" 1/4W 4.7 KOHM+-5%	RCR4341		1		1
R804	" 1/4W 1.2 KOHM+-5%	RCR4334		1		1
R805	" 1/4W 6.8 KOHM+-5%	RCR4343		1		1
R806	" 1/4W 3.9 KOHM+-5%	RCR4340	1	1	1	1
R807	" 1/4W 3.9 KOHM+-5%	RCR4340		1		1
R808	" 1/4W 10 KOHM+-5%	RCR4345	1	1	1	1
R809	" 1/4W 1.5 KOHM+-5%	RCR4335	1	1	1	1
R810	R,METAL 1/4W 158 KOHM+-1%	RME0624	1	1		
R811	" 1/4W 158 KOHM+-1%	RME0624	1	1		
R812	R,CARBON 1/4W 1.5 KOHM+-5%	RCR4335			1	1
R813	" 1/4W 8.2 KOHM+-5%	RCR4344	1	1	1	1
R814	" 1/4W 2.2 KOHM+-5%	RCR4337	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R815	R,CARBON 1/4W 12 KOHM+-5%	RCR4346	1	1	1	1
R816	" 1/4W 68 OHM+-5%	RCR4319	1	1	1	1
R812	R,CARBON 1/4W 1.2 KOHM+-5%	RCR4334	1	1		
R810	M,METAL 1/4W 127 KOHM+-1%	RME0623			1	1
R811	" 1/4W 127 KOHM+-1%	RME0623			1	1
R821	" 1/4W 6.19 KOHM+-1%	RME0622	1	1	1	1
R822	" 1/4W 6.19 KOHM+-1%	RME0622	1	1	1	1
R823	R,CARBON 1/2W 100 KOHM+-5%	RCR3207	1	1		
R824	" 1/2W 100 KOHM+-5%	RCR3207	1	1		
R825	" 1/4W 3.3 KOHM+-5%	RCR4339	1	1	1	1
R826	" 1/4W 3.3 KOHM+-5%	RCR4339	1	1	1	1
R827	R,METAL 5 W 22 KOHM+-5%	RMR2853	1	1		
R828	" 5 W 22 KOHM+-5%	RMR2853	1	1		
R829	R,CARBON 1/4W 270 OHM+-5%	RCR4326	1	1	1	1
R830	" 1/4W 270 OHM+-5%	RCR4326	1	1	1	1
R823	" 1/2W 68 KOHM+-5%	RCR3203			1	1
R824	" 1/2W 68 KOHM+-5%	RCR3203			1	1
R827	R,METAL 5 W 10 KOHM+-5%	RMR2851			1	1
R828	" 5 W 10 KOHM+-5%	RMR2851			1	1
RV804	VR,CARBON EVL-SOAA00B23	RDE0015		1		1
		HX8311711		R		R
		HX8311704		R		R
RV806	VR,CARBON EVL-SOAA00B53	RDE0004		1		1
		HX8311711		R		R
		HX8311704		R		R
RV812	VR,CARBON EVL-SOAA00B13	RDE0014	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
RV816	VR,CARBON EVL-SOAA00B22	RDE0012	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
P801	CONNECTOR 171825-5	JBX0454	1	1	1	1
PEF-468C	PCB	HX116413	1	1	1	1
	"	HX283858	R	R	R	R
	"	HX8311790	R	R	R	R
C903	C,CERAMIC 50 V 0.01 PF+-1%	CCC1339	1	1	1	1
C905	" 50 V 47 PF+-5%	CCC1318	1	1	1	1
C906	" 500 V 1 PF+-0.25PF	CCC1353	1	1	1	1
C907	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C911	" 250 V 4.7 UF	CEC0219	1	1	1	1
C912	" 25 V 10 UF	CET0020	1	1	1	1
C920	" 25 V 10 UF	CET0020			1	1
D901	DIODE 1S2075K T-D	HDS0331	1	1	1	1
D902	" 1S2075K T-D	HDS0331		1		1
D903	" 1S2075K T-D	HDS0331	1	1	1	1
D908	" 1S2075K T-D	HDH0147	1	1	1	1
TR901	TRANSISTOR 2SC458C	HTC0148	1	1	1	1
TR902	" 2SC458C	HTC0148	1	1	1	1
TR903	" 2SD668A-C	HTD0100	1	1	1	1
TR904	" 2SC1722	HTC0514	1	1	1	1
R901	R,CARBON 1/4W 47 KOHM+-5%	RCR4353	1	1	1	1
R902	" 1/4W 10 KOHM+-5%	RCR4345	1	1	1	1
R903	" 1/4W 10 KOHM+-5%	RCR4345	1	1	1	1
R904	" 1/4W 68 KOHM+-5%	RCR4355	1	1	1	1
R905	" 1/4W .680 OHM+-5%	RCR4331	1	1	1	1
R906	" 1/2W 47 KOHM+-5%	RCR3199	1	1	1	1
R907	" 1/4W 2.2 KOHM+-5%	RCR4337	1	1	1	1
R908	R,METAL 2 W 22 KOHM+-5%	RMR2807	1	1		
R908	" 2 W 10 KOHM+-5%	RMR2805			1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R909	R,CARBON 1/4W 1 KOHM +-5%	RCR4333	1	1		
R909	" 1/4W 820 OHM +-5%	RCR4332			1	1
R910	" 1/4W 470 OHM +-5%	RCR4329	1	1	1	1
R911	" 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
R912	" 1/4W 470 OHM +-5%	RCR4329	1	1	1	1
R913	" 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
P905	CONNECTOR 171825-3	JBX0468	1	1	1	1
P902	" 171825-8	JBX0467	1	1	1	1

ELECTRICAL REPLACEABLE PARTS LIST
CIRCUIT BOARD(PEF-469)

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
C320	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C323	C,CERAMIC 50 V 68 PF+-5%	CCC1034	1	1		
C325	" 50 V 22 PF+-5%	CCC1314			1	1
C326	" 50 V 0.01 PF+-1%	CCC1339	1	1	1	1
C327	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C331	C,CERAMIC 50 V 15 PF+-5%	CCC1312			1	1
C331	" 50 V 27 PF+-5%	CCC1315	1	1		
C332	" 500 V 1 PF+-0.25PF	CCC1353	1	1	1	1
C333	" 500 V 1 PF+-0.25PF	CCC1353	1	1	1	1
C334	C,AL ELYC 25 V 10 UF	CET0020	1	1	1	1
C338	C,CERAMIC 500 V 1000 PF+-10%	CCD0218	1	1	1	1
C343	" 500 V 1000 PF+-10%	CCD0218	1	1	1	1
C344	" 500 V 1000 PF+-10%	CCD0218	1	1	1	1
C345	" 500 V 1000 PF+-10%	CCD0218	1	1	1	1
C346	" 500 V 1000 PF+-10%	CCD0218	1	1	1	1
C350	" 500 V 1000 PF+-10%	CCC1310	1	1	1	1
C1102	C,AL ELYC 250 V 4.7 UF	CEC0219	1	1	1	1
CV330	C,VARIABLE ECV-1ZW40 × 60	CVE0027	1	1	1	1
CV323	C,VARIABLE ECV-1ZW40 × 60	CVE0027			1	1
D301	DiODE HZ5B T-D	HDH0147	1	1	1	1
D302	" HZ5B T-D	HDH0147	1	1	1	1
D303	" HZ5B T-D	HDH0147	1	1	1	1
D1103	" 1S2075K T-D	HDS0331	1	1	1	1
L336	COIL FL-3H 1ROM	TLF0054			1	1
L337	" FL-3H 1ROM	TLF0054			1	1
L336	" FL-3H 3ROM	TLF0060	1	1		
L337	" FL-3H 3ROM	TLF0060	1	1		
TR1101	TRANSISTOR 2SC1723	HTC0492	1	1	1	1
TR1102	" 2SC1722	HTC0514	1	1	1	1
TR303	" 2SC1906	HTC0338	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
TR304	TRANSISTOR 2SC1906	HTC0338	1	1	1	1
TR305	" 2SC641K	HTC0192	1	1	1	1
TR306	" 2SC641K	HTC0192	1	1	1	1
TR307	" 2SD668A-C	HTD0100	1	1	1	1
TR308	" 2SD668A-C	HTD0100	1	1	1	1
TR309	" 2SB648A-C	HTB0087	1	1	1	1
TR310	" 2SB648A-C	HTB0087	1	1	1	1
TR311	" 2SA781K	HTA0099	1	1	1	1
TR312	" 2SA781K	HTA0099	1	1	1	1
R320	R,CARBON 1/4W 2.2 KOHM +-5%	RCR4337			1	1
R321	" 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
R322	" 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
R323	" 1/4W 100 OHM +-5%	RCR4321			1	1
R324	" 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
R325	" 1/4W 10 OHM +-5%	RCR4309			1	1
R1101	R,METAL 1 W 33 KOHM +-5%	RMR2785	1	1		
R1101	R,CARBON 1/2W 15 KOHM +-5%	RCR3187			1	1
R1103	" 1/2W 22 KOHM +-5%	RCR3191	1	1		
R1103	" 1/2W 22 KOHM +-5%	RCR3191			1	1
R1104	R,METAL 1/4W 113 KOHM +-1%	RME0633	1	1		
R1104	" 1/4W 88.7 KOHM +-1%	RME0618			1	1
R1105	" 1/4W 20.5 KOHM +-1%	RME0617	1	1	1	1
R326	R,CARBON 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R327	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R328	" 1/4W 680 OHM +-5%	RCR4331	1	1	1	1
R329	" 1/4W 680 OHM +-5%	RCR4331	1	1	1	1
R330	" 1/4W 2.4 KOHM +-5%	RCR3061	1	1	1	1
R331	" 1/4W 2.4 KOHM +-5%	RCR3061	1	1	1	1
R332	M,METAL 1 W 33 KOHM +-5%	RMR2785	1	1		
R333	" 1 W 33 KOHM +-5%	RMR2785	1	1		

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R334	R,CARBON 1/4W 22 OHM +-5%	RCR4313	1	1	1	1
R335	" 1/4W 22 OHM +-5%	RCR4313	1	1	1	1
R336	" 1/4W 470 OHM +-5%	RCR4329	1	1		
R337	" 1/4W 470 OHM +-5%	RCR4329	1	1		
R338	" 1/2W 47 KOHM +-5%	RCR3199	1	1		
R339	R,METAL 1 W 47 KOHM +-5%	RMR2786	1	1		
R340	" 1 W 47 KOHM +-5%	RMR2786	1	1		
R341	R,CARBON 1/4W 22 OHM +-5%	RCR4313	1	1	1	1
R342	" 1/4W 22 OHM +-5%	RCR4313	1	1	1	1
R343	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R344	" 1/4W 2.2 KOHM +-5%	RCR4337	1	1	1	1
R345	" 1/4W 220 OHM +-5%	RCR4325	1	1		
R345	" 1/4W 180 OHM +-5%	RCR4324			1	1
R346	" 1/4W 220 OHM +-5%	RCR4325	1	1		
R346	" 1/4W 180 OHM +-5%	RCR4324			1	1
R332	R,METAL 1 W 22 KOHM +-5%	RMR2784			1	1
R333	" 1 W 22 KOHM +-5%	RMR2784			1	1
R339	R,CARBON 1/2W 33 KOHM +-5%	RCR3195			1	1
R340	" 1/2W 33 KOHM +-5%	RCR3195			1	1
R336	" 1/4W 220 OHM +-5%	RCR4325			1	1
R337	" 1/4W 220 OHM +-5%	RCR4325			1	1
R338	" 1/2W 33 KOHM +-5%	RCR3195			1	1
R350	" 1/4W 100 OHM	RCR4321	1	1	1	1
P301	CONNECTOR 171825-8	JBX0467	1	1	1	1
C1034	C,CERAMIC 500 V 1000 PF +-10%	CCD0218	1	1	1	1
D1032	DIODE HZ24B	HDH0091			1	1
PEF-469	PCB	HX116413	R	R	R	R
	"	HX283858	R	R	R	R
	"	HX8311790	R	R	R	R
R1032	R,CARBON 1/4W 100 KOHM +-5%	RCR4357			1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R1033	R,CARBON 1/4W 47 KOHM +-5%	RCR4353	1	1		
R1033	" 1/4W 33 KOHM +-5%	RCR4351			1	1
R1034	" 1/4W 47 KOHM +-5%	RCR4353	1	1		
R1034	" 1/4W 33 KOHM +-5%	RCR4351			1	1
R1036	" 1/4W 220 OHM +-5%	RCR4325			1	1
RV1033	VR,CARBON EVT-S0AA00B54	RDE0018	1	1	1	1
		HX8311713	R	R	R	R
		HX8311704	R	R	R	R
RV1035	VR,CARBON EVT-S0AA00B25	RDE0029	1	1	1	1
		HX8311713	R	R	R	R
		HX8311704	R	R	R	R
P1031	CONNECTOR 171825-3	JBX0468	1	1	1	1

ELECTRICAL REPLACEABLE PARTS LIST
CIRCUIT BOARD(PEF- 470,471)

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R1031	R,CARBON 1/4W 100 KOHM +-5%	RCR4357	1	1	1	1
JI032	SOCKET PS-085	JSP0001	1	1	1	1
PEF-470	PCB	HX116413	R	R		
		HX283858	R	R		
		HX8311790	R	R		
PEF-471	PCB	HX116413			R	R
		HX283858			R	R
		HX8311790			R	R

ELECTRICAL REPLACEABLE PARTS LIST
CIRCUIT BOARD(PEF-472)

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
C271	C,CERAMIC 50 V10000 PF	CCC1030	1		1	
TR271	TRANSISTOR 2SK106C	HTK0068	1		1	
TR272	" 2SC458C	HTC0148	1		1	
R271	R,CARBON 1/4W 470 KOHM +-5%	RCR4365	1		1	
R272	" 1/4W 10 KOHM +-5%	RCR4345	1		1	
R273	" 1/4W 470 OHM +-5%	RCR4329	1		1	
R274	" 1/4W 6.8 KOHM +-5%	RCR4343	1		1	
RV273	VR,CARBON EVL-SOAA00B23	RDE0015	1		1	
		HX8311711	R		R	
		HX8311704	R		R	
RV815	VR,CARBON EVH-Y13K20B14	RDE0003	1	1	1	1
		HX8311705	R	R	R	R
		HX8311701	R	R	R	R
RV518	VR,CARBON EWK-E0AK20B23B15	RDE0026	1		1	
		HX8311703	R		R	
		HX8311709	R		R	
RV518	VR,CARBON EVH-CCAK20B23	RDE0027		1		1
		HX8311702		R		R
		HX8311708		R		R
R518	R,CARBON 1/4W 820 OHM +-5%	RCR4332	1	1	1	1
R519	" 1/4W 100 OHM +-5%	RCR4321	1	1	1	1
R807	" 1/4W 1 KOHM +-5%	RCR4333	1		1	
RV806	VR,CARBON EVL-SOAA00B53	RDE0004	1		1	
		HX8311711	R		R	
		HX8311704	R		R	
C1202	C,PLASTiC 50 V 0.01 UF+-10%	CQA0077	1	1	1	1
C1203	C,AL ELYC 25 V 100 UF	CEC0177	1	1	1	1
C1204	C,CERAMIC 50 V 1000 PF +-1%	CCC1336	1	1	1	1
IC1201	IC CD4011UBE	IDC0089	1	1	1	1
R1201	R,CARBON 1/4W 39 KOHM +-5%	RCR4352	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
R1202	R,CARBON 1/4W 47 KOHM +-5%	RCR4353	1	1	1	1
R1203	" 1/4W 15 KOHM +-5%	RCR4347	1	1	1	1
R1204	" 1/4W 750 OHM +-5%	RCR3049	1	1	1	1
RV1203	VR,CARBON EVL-SOAA00B53	RDE0004	1	1	1	1
		HX8311711	R	R	R	R
		HX8311704	R	R	R	R
PEF-472	PCB	HX116413	R	R	R	R
	"	HX283858	R	R	R	R
	"	HX8311790	R	R	R	R

ELECTRICAL REPLACEABLF PARTS LIST
CIRCUIT BOARD(PEF-473,474)

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
C1	C,PLASTIC 600 V22000 PF+-10%	CQX0071		1		1
S1	SW,SLIDE SSB023 L=9NS PCB	SSV0042		1		1
PEF-473	PCB	HX116413		R		R
		HX283858		R		R
		HX8311790		R		R
C101	C,PLASTIC 600 V22000 PF+-10%	CQX0071	1	1	1	1
S101	SW,SLIDE SSB023 L=9 NS PCB	SSV0042	1	1	1	1
PEF-474		HX116413	R	R	R	R
		HX283858	R	R	R	R
		HX8311790	R	R	R	R

ELECTRICAL REPLACEABLE PARTS LIST
CIRCUIT BOARD(CHASSIS)

Symbol	Description		Code	Qty			
				V-151	V-152	V-301	V-302
J1201	CONNECTOR		HX4114183	1	1	1	1
F1101	FUSE	MF61NM 1 (1A 250V)JIS	EFG0344	R	R	R	R
D1112	DIODE	SR103D (WITH MOUNT)	HDS0234	1	1	1	1
J1	COAX.CON	BNC071	JHB0088		1		1
J101	COAX.CON	BNC071	JHB0088	1	1	1	1
P1101	CONNECTOR		HX3133769	1	1	1	1
F1101	FUSE	MF61NM 2 (2A 250V)JIS	EFG0352	1	1	1	1
FH1101	SOCKET,FUS	SN-1301	EFH0193	1	1	1	1
RV1101	VR,CARBON	EVC-BMDK20B14 10K WITH SW	RDE0023	1	1	1	1
			H 8311706	R	R	R	R
			H 8311701	R	R	R	R
T1101	XFMR	T501	HX8311681	1	1	1	1
RV1016	VR,CARBON	EVM-R7GS20B26	RDE0028	1	1	1	1
			H 8311714	R	R	R	R
RV1026	VR,CARBON	EVH-COAS15B14	RDE0009	1	1	1	1
			H 8311707	R	R	R	R
			H 8311702	R	R	R	R
L1026	COIL		HX8311683	1	1	1	1
DL301	DELAY LINE	CD-3A	HX8311741			1	1
V1001	CRT	130BUB31	DPX0019	1	1		
V1001	CRT	130BTB31	DPX0054			1	1
P1020	ANODECAP	C-502R(0.8M)	DYC0001			1	1
J401	COAX.CON	BNC071	JHB0088	1	1	1	1
J402	JACK	TJ-3020	JJT0028	1	1	1	1
J901	COAX.CON	BNC071	JHB0088	1	1	1	1
			ERS0003	1	1	1	1
J2	MULTI.CON	J2	HX3142036		1		1
J102	MULTI.CON	J102	HX3142036	1	1	1	1
J905	MULTI.CON	J905	HX3142036	1	1	1	1
J1031	MULTI.CON	J1031	HX3142036	1	1	1	1

Symbol	Description	Code	Qty			
			V-151	V-152	V-301	V-302
J801	MULTI.CON J801	HX3142036	1	1	1	1
J1002	MULTI.CON J1002	HX3142036	1	1	1	1
J201-251	MULTI.CON J201	HX3142036		1		1
J202-405	MULTI.CON J202	HX3142036		1		1
J203-406	MULTI.CON J203	HX3142036	1	1	1	1
J1102	MULTI.CON J1102	HX3142036	1	1	1	1
J301	MULTI.CON J301	HX3142036	1	1	1	1
J1001	CONNECTOR 171822-3	JBX0449	1	1	1	1
	CONTACT 170205-1	JYX0252	2	2	2	2
	CONNECTOR 163690-9 (2.5MM)	JBX0043	1	1	1	1
	CONTACT 163691-1	JYX0059	6	6	6	6
R71	R,CARBON 1/4W 47 OHM +-5%	RCR3020		1		1
R171	R,CARBON 1/4W 47 OHM +-5%	RCR3020	1	1	1	1
R400	R,CARBON 1/4W 100 OHM +-5%	RCR3028	1	1	1	1

MECHANICAL REPLACEABLE PARTS LIST(V-301,V-302)

Symbol	Description	Code	Qty	Remarks
1	Subpanel, front	112134	1	
	Cushion	8316262-B	1	
2A	Panel, front	284347～48	1	V-301
2B	Panel, front	284349～50	1	V-302
3	Panel, rear	284355	1	
4	Angle	284352	2	
5	Angle	285083	1	
6	Angle	284395	1	
7	CRT shield plate	3140790	1	
	Cushion	8316262-E		
8	CRT band	3140791-A	1	
9	CRT band	3140791-B	1	
10	Rubber	3144055-B	2	
	Rubber	8322428-A	1	
11	Shield band	8316268-B	1	
	Rubber	8322428-B	1	
12	Band	ERL0009	2	
13	Bracket, H board	8312141	1	
14	Bracket, L	8318957		
15	Shield plate, TIME	8312139	1	
16	Bracket, VR	8312140	1	
17	Plate	8318971	1	
18	Cover	284358	1	
19	Foot	3140755	8	
20	Cover	284357	1	
21	Handle	8305589	1	
21	Knob	3144092	1	
23	Knob	3140805	3	
24	Knob	3140803	8	
25	Knob	3140804	3	

Symbol	Description	Code	Qty	Remarks
26	Bush	ERR0073	1	
27	Cord bush	8312120-B	1	
28	Label	8316162	1	
29	Support	XCi0043	6	
30	Spacer	XCi0097	1	
31A	Bezel	282239	1	for V-301
	Name plate	8316261-C	1	
	Dial plate	3147500	1	
	Clip	XCF0141	2	
31B	Bezel	282239	1	for V-302
	Name plate	8316261-D	1	
	Dial plate	3147500	1	
	Clip	XCF0141	2	
32	Board	PEF-467	1	
	Shield case	8316093	1	
	Heat sink	8329719	4	
	Earth plate	8318959	2	
33	Board	PEF-468	1	
	Heat sink	8329719	2	
34	Board	PEF-469	1	
	Heat sink	8329720	2	
35	Board	PEF-472	1	
36	Screw, pan head	XCA0065	3	M2 × 5
37	Screw, flat	XCA7306	23	M3 × 6
38	Screw, flat	XCA0168	4	M2.6 × 4
39	Screw	XCA6316	1	M3 × 16
40	Screw	XCA1598	12	M3 × 5
41	Screw	XCA6308	21	M3 × 8
42	Screw	XCA1797	2	M3 × 20
43	Washer	XCA0133	1	M3

Symbol	Description	Code	Qty	Remarks
44	Washer, spring	XCA0107	1	M3
45	Nut	XCA1706	1	M3
46	Screw	XCA6410	4	M4 × 10
47	Screw	XCA0126	2	M4 × 16
48	Washer	XCA0134	3	M4
49	Washer, spring	XCA0108	2	M4
50	Nut	XCA1707	2	M4
51	Screw, flat	XCA7308	2	M3 × 8

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